IMPACT DOT MATRIX PRINTER

OPTION: PULL-UP TRACTOR FEEDER

SERVICE MANUAL

MECHANISMS & ELECTRONICS

IMPACT DOT MATRIX PRINTER

OPTION: PULL-UP TRACTOR FEEDER

SERVICE MANUAL

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PREFACE

This publication is a service manual covering specifications, operating instructions, and technical information on the Impact Dot Matrix Printer and the optional Pull-up Tractor Feeder. It is intended for service personnel and other concerned persons, to accurately and quickly provide after-sale service for our printers and options.

To perform appropriate maintenance so that the printer and the option are always in best condition for the customer, the service personnel must adequately understand and apply this manual.

Impact dot matrix printer

The printer manual is made up of four chapters and appendices.

CHAPTER I. **SPECIFICATIONS**
CHAPTER II. **THEORY OF OPERATION**
CHAPTER III. **MAINTENANCE**
CHAPTER IV. **TROUBLESHOOTING**

APPENDICES
A. Logic Control Circuitry Schematic Diagrams
B. Switch Panel Circuitry Schematic Diagram
C. Power Supply Circuitry Schematic Diagrams
D. Interface Circuitry Schematic Diagram
E. Wiring Diagram

Optional pull-up tractor feeder

The feeder manual is made up of two chapters.

CHAPTER I. **APPLICATION**
CHAPTER II. **PARTS REPLACEMENT**

We hope this manual contributes to proper maintenance service.

Impact Dot Matrix Printer

CHAPTER I.

SPECIFICATIONS

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1. GENERAL DESCRIPTION

This machine is a high-speed, serial wire dot-matrix printer with a released type print head having 18 print wires. It prints 800 characters per second (Pica pitch, high-speed mode).

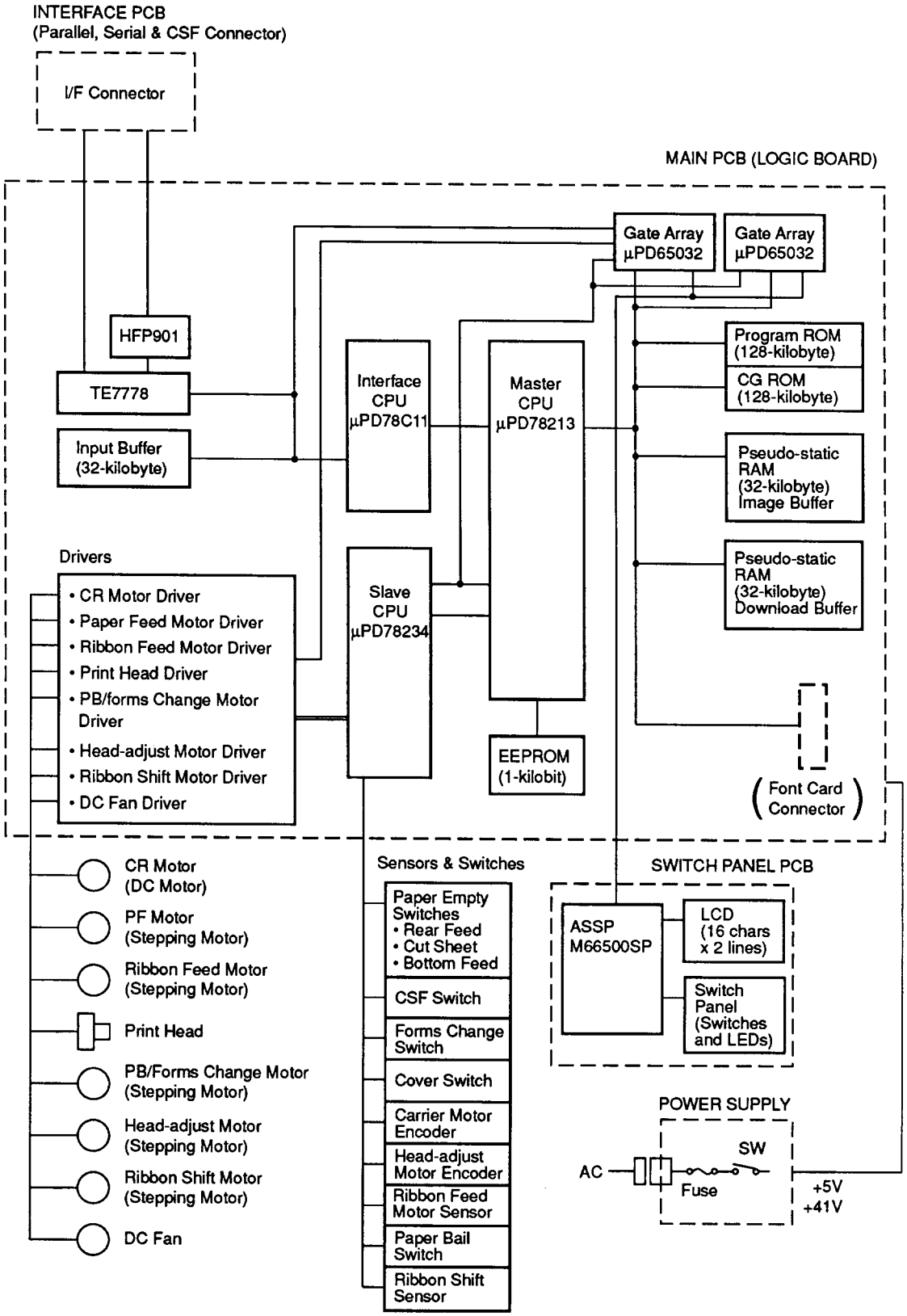
The printer accepts cut forms, fanfolded continuous forms, label forms, and envelopes (This machine is equipped with a push tractor feeder as standard).

This printer supports the IBM- and Epson-emulation modes*

* IBM-emulation mode: Mode compatible with the IBM Proprinter III XL
Epson-emulation mode: Mode compatible with the Epson FX-1050

The optional features include the Cut Sheet Feeder (CSF), the pull-up tractor, the ribbon shift mechanism for color printing, and the automatic head-adjust mechanism (automatic forms thickness control).

2. CONFIGURATION



3. BASIC SPECIFICATIONS

3.1 Emulation Mode

- IBM Proprinter III XL
- Epson FX-1050

3.2 Printing Mechanism

(1) Print Method	Impact dot-matrix
(2) Print Head	18 pins vertically arranged in dual line Release type
• Diameter of pin	0.29 mm
• Dot pitch	Vertical: 1/72" Horizontal: 1/120" (Draft), 1/240" (NLQ)
• Service life	Approx. 300 million dots/pin (when printing with a black fabric ribbon)

(3) Print Speed (cps)

• High-speed draft pica	800
• Draft pica	600
• Draft elite	720
• Draft 15 cpi	600
• NLQ pica	150
• NLQ elite	180

(4) Print Quality: High-speed draft, Draft, or NLQ

(5) Print Pitch: Pica, condensed pica, elite, condensed elite, 15 cpi, and proportional spacing

(6) Print Direction
- Bidirectional logic seeking printing
- Unidirectional printing (Under command control or from the switch panel)

(7) Maximum Print Length: 13.6 inches/line

(8) Number of Characters per Line (CPL)

Pica:	136	(10 cpi)
Condensed pica:	233	(17 cpi)
Elite:	163	(12 cpi)
Condensed elite:	272	(20 cpi)
15 pitch:	204	(15 cpi)

(9) Dot Density in Bit Image Mode

	Dots/Line	Dots/Inch
Single-density	816	60
Double-density, Double-density & double-speed	1632	120
Triple-density	2448	180
Quadruple-density	3264	240
CRT graphic I	1088	80
CRT graphic II	1224	90
Single-density plotter graphics	979	72
Double-density plotter graphics	1958	144

(10) Character Formation

(Character width + Spaces) x Height

		Characters	Graphics
• High-speed draft mode		(7 + 2) x 7	(9 - 1 + 1) x 12
• Draft mode	10 cpi	(9 + 3) x 7	(11 + 1) x 12
	12 cpi	(7 + 3) x 7	(9 + 1) x 12
	15 cpi	(9 + 3) x 7	(11 + 1) x 12
	17 cpi	(9 + 5) x 7	(11 + 3) x 12
	20 cpi	(7 + 5) x 7	(9 + 3) x 12
• NLQ mode	10 cpi	(19 + 5) x 14	(23 + 1) x 24
	12 cpi	(19 + 1) x 14	(23 - 4 + 1) x 24
	15 cpi	(19 + 13) x 14	(23 + 9) x 24
	17 cpi	(19 + 9) x 14	(23 + 5) x 24
	20 cpi	(19 + 5) x 14	(23 + 1) x 24

(11) Character Sets

- IBM-emulation: 160 standard characters plus 12 Scandinavian characters, and multilingual characters ECMA-94
- Epson-emulation: 96 ASCII characters, 43 national characters (18 countries) and the same characters in italic, multilingual characters ECMA-94

(12) Font

Draft: Pica and elite

NLQ: Prestige (10), Brougham (10), Gothic (10), Roman (10), Sans serif (10), Quadro (10), Anelia PS, OCR-A (10), and OCR-B (10)

(13) Copy Capability

- Rear feeding: 6 copies including an original
- Bottom feeding (option): 6 copies including an original

(For paper with 34 kg/ream or 40 g/m^2)

(14) Print Position Quality

- Line feed accuracy (in 1/6" pitch)

4.23±0.5 mm/line

4.23±0.2 mm/line (for single-part forms with 55 kg/ream or 64 g/m2)

3.3 Switch Panel

See Section 6.

3.4 Carrier Drive Mechanism

(1) Drive Source	DC motor
(2) Drive Method	Timing belt

3.5 Paper Feed Mechanism

(1) Drive Source

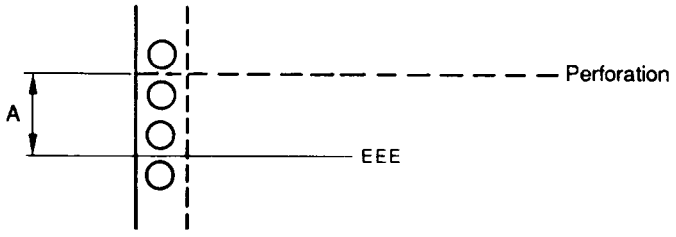
• Paper feed motor	Stepping motor, 1.8°/step, 2-2 phase excitation

(2) Drive Method

• Cut forms	- Friction feed - Cut sheet feeder (opt.)
• Continuous forms	
Rear feed	- Push tractor
Bottom feed	- Pull-up tractor (opt.)

(3) Line Feed Pitch	1/6", 1/8", and 1/216" x N programmable pitch
(4) Paper Feed Speed	
• Single feed in 1/6" pitch	4.5 ips
• Continuous feed	More than 9.3 ips
(5) Paper Feed Direction	Forward and reverse (The reverse feeding is impossible when the CSF or pull-up tractor is used.)
(6) Paper Parking Function	Continuous forms (if already loaded in the rear push tractor) will be fed back from the printer inside to the tractor feeder while the EJECT switch is held down.

(7) First Print Line



When the forms are automatically fed, the factory-default distance "A" between the perforation or the top edge of the page and the center of the characters on the first line, is 13/12 inches (27.5 mm). The factory default can be changed from the switch panel in FUNCTION setting mode.

3.6 Forms

(1) Forms Available	Cut forms, continuous forms, label forms, and envelopes
(2) Cut Forms	
• Width	4-16.5" (101.6-419.1 mm)
• Length	4-14.3" (101.6-363.2 mm)
• Thickness	
Single-part	2.56-3.94 mil (0.065-0.10 mm)
Multi-part	Total thickness: 11.81 mil (0.30 mm)
• Paper Weight	
Single-part	52-80 g/m² (14-21 lbs. or 45-69 kg/ream)
Multi-part	40 g/m² chemical carbon (10 lbs. or 34 kg/ream)
• Gluing	Multi-part forms shall be glued securely only at the top edge to prevent sheet displacement.
(3) Continuous Forms	
• Width	4-16.5" (101.6-419.1 mm)
• Thickness	
Single-part	2.56-5.12 mil (0.065-0.13 mm)
Multi-part	Total thickness: 14.96 mil (0.38 mm)
• Paper Weight	
Single-part	52-105 g/m² (14-27 lbs. or 45-90 kg/ream)
Multi-part	40 g/m² chemical carbon (10 lbs. or 34 kg/ream)
(4) Label Forms	
• Width	4-16.5" (101.6-419.1 mm)
• Thickness	7.09 mil (0.18 mm) max.
(5) Envelopes	
• Size	10.2 x 7.5" (260 x 190 mm)
• Thickness	1.97-4.92 mil (0.05-0.125 mm)
• Paper Weight	40-105 g/m² (10-27 lbs. or 35-90 kg/ream)

For detailed forms specifications, refer to Section 4.

3.7 Ribbon Feed and Shift Mechanisms

(1) Drive Source

• Ribbon feed motor	Stepping motor, 7.5°/step 2-2 phase excitation
• Ribbon shift motor (On models equipped with the ribbon shift mechanism)	Stepping motor, 7.5°/step 2-2 phase excitation

(2) Ribbon Type and Service Life

- Models equipped with the ribbon shift mechanism

Type		Size	Service life
Black	• Standard	1" wide, 54 m	14 million chars
	• Option	1/2" wide, 64 m	7 million chars
Color	• Option	1" wide, 54 m	2 million chars*

* For black ribbon section

- Models without the ribbon shift mechanism

Type		Size	Service life
Black	• Standard	1/2" wide, 64 m	7 million chars

3.8 Memory Capacity

(1) RAMs

- Standard — Total 96 kilobytes

- 2-line image buffer:	26 kilobytes
- Input data buffer:	32 kilobytes
- Download buffer:	27 kilobytes
- Line buffer:	2 kilobytes
- Work area:	4 kilobytes
- Bar code buffer:	4 kilobytes
	(One kilobyte is reserved.)

(2) ROMs

- Standard

Program ROM:	1 megabyte
Font CG ROM:	1 megabyte

3.9 Reliability

(1) Mean Time Between Failures (MTBF)	Min. 10,000 hours with power on Min. 2,500 hours of operation (excluding the print head)
(2) Mean Time To Repair (MTTR)	Within 30 minutes (provided that the defective section is replaced as a unit.)
(3) Printer Service Life	5 years

The above values are obtained provided that regular maintenance work is performed.

3.10 Detecting and Protecting Functions

(1) Detecting Functions

- Paper Empty (PE)

  This function detects the paper empty state, turns on the CHECK lamp, shows the error message ("PAPER EMPTY FORMS ERROR", "PAPER EMPTY SHEET ERROR", or "PAPER EMPTY BOTTOM ERROR") on the LCD, and stops printing.

- Memory Checks

  The EEPROMs, ROMs, RAMs are checked when the power is first applied. If the system detects any error in the memories, it flashes the CHECK lamp and shows the error message ("EEPROM#1 ERROR", "EEPROM#2 ERROR", "CG ROM ERROR", "PROGRAM ROM ERROR", "IMAGE D/L RAM ERROR", or "INPUT BUFFER RAM ERROR") on the LCD.

- Cover Switch

  If the top cover is opened, the CPU detects the cover-open signal and changes the printer offline. The error message "COVER OPEN ERROR" appears on the LCD as the CHECK lamp comes on.

- Encoder Slit (Head-adjust) Sensor
- Ribbon Shift Sensor

} (Only for those models equipped with the ribbon shift mechanism)

(2) Protecting Functions

- Print Duty Monitor

  This function monitors the print duty to prevent the print head from overheating.

  It counts the number of dots on every line in the image buffer and registers it into the duty counter. If the duty counter counts up to the specified value, the printer logic automatically causes soft delay.

  This function also counts the number of dots on 48 columns. If the dot duty exceeds 50%, the printer splits output into two passes.

- Error Detectors

  This printer incorporates the error detectors for the head driver transistors, paper feed motor driver/carrier motor driver, stepping motor driver transistors, ribbon feed motor driver transistors, cooling fan, and +41V source output drop. For details, refer to Chap. II, Subsection 2.3.11.

- Overcurrent and Overvoltage Protectors in Power Supply

  These protectors prevent the power supply from overheating. For details, refer to Chap. II, Section 2.4.

3.11 Hexadecimal Dump and Self Print Tests

(1) Hexadecimal Dump

This printer has a diagnostic hexadecimal dump function which prints the data transmitted from the computer in hexadecimal form. This function is activated by turning the POWER switch on while holding down the SEL and LF switches, and is terminated by turning the printer power off and then on again. During the hexadecimal dump operation, the "HEX DUMP MODE" appear on the LCD.

(2) Self-print Tests

To allow the operator to check the printing function and quality without connection to the computer, this printer incorporates three types of the self-print functions: draft test, high-speed draft test, and all-mode print test. The draft and high-speed draft test functions produce a printout with draft ASCII characters; the all-mode print test function, a continuous printout in all print modes.

The draft test is activated by turning on the POWER switch with the SEL switch held down; the high-speed draft test, by turning on the POWER switch with the LF switch held down; the all-mode print test, by turning on the POWER switch with the EJECT switch held down.

During each of the above self-print tests, the LCD shows the "SELF PRINTING DRAFT MODE", "SELF PRINTING HS DRAFT MODE", or "SELF PRINTING ALL PRINT MODE".

(3) Demonstration Print, Quality Check Print, and Revision Print

Turning on the POWER switch while holding down the SEL and TOF switches produces demonstration pattern printout as the "SELF PRINTING DEMO PRINT MODE" appears on the LCD.

Turning on the POWER switch while holding down the TOF and PAPER SELECT switches produces patterns for quality check as the "SELF PRINTING QUALITY CHECK" appears on the LCD. The printout includes the settings stored in the EEPROM.

Turning on the POWER switch while holding down the LF and EJECT switches prints each parts code and revision number of the master program, interface program, and slave program, as the "SELF PRINTING REVISION MODE" appears on the LCD.

To stop the above printing, turn off the POWER switch.

3.12 Function Mode and Service Modes

This printer provides the Function mode and Service modes (offline and online) to allow access to the setting values stored in the EEPROM. In the Function mode, the user can select the print quality, character pitch, line feed pitch, font, ribbon type, emulation mode, character set, interface, page length, margins, print attributes, and other various printing conditions from the switch panel (see Section 6). Those setting values become defaults.

The Service modes shall be used in the factory or by the service personnel only, for adjusting the main PCB setting for the optional mechanisms, head-platen gap, paper cutting position, top-of-form (TOF) position, print start position, vertical character alignment, and ribbon shift amount. The Service modes can be activated from the switch panel. Note that in the online Service mode, the setting values can be modified with control commands. (See Section 6.)

The current settings stored in the EEPROM can be printed out with the quality-check print feature which is activated by turning the POWER switch on while holding down the TOF and PAPER SELECT switches.

3.13 Interface

- Centronics parallel interface
- RS-232C serial interface

3.14 Noise Level

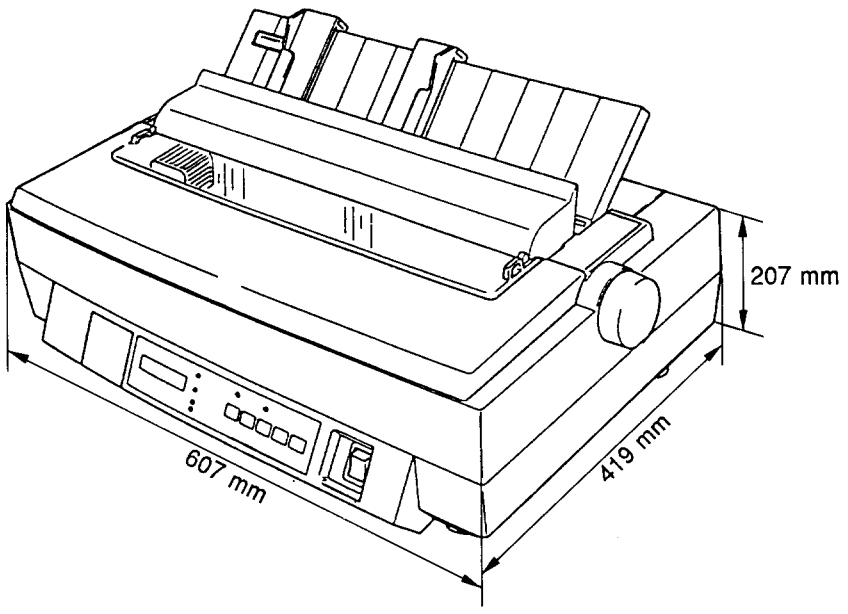
57 dB in normal-speed mode
55 dB in quiet mode

(ISO 7779), when printing in draft mode with the standard push tractor feeder

(Except for the print area within one inch from the perforation on the continuous forms.)

3.15 External Dimensions and Weight

• External dimensions (W) x (D) x (H)	Approx. 607 x 419 x 207 mm (Approx. 23.9 x 16.5 x 8.15 in.)
• Weight	Approx. 20 kg (44 lbs.)



4. FORMS SPECIFICATIONS

4.1 Cut Forms

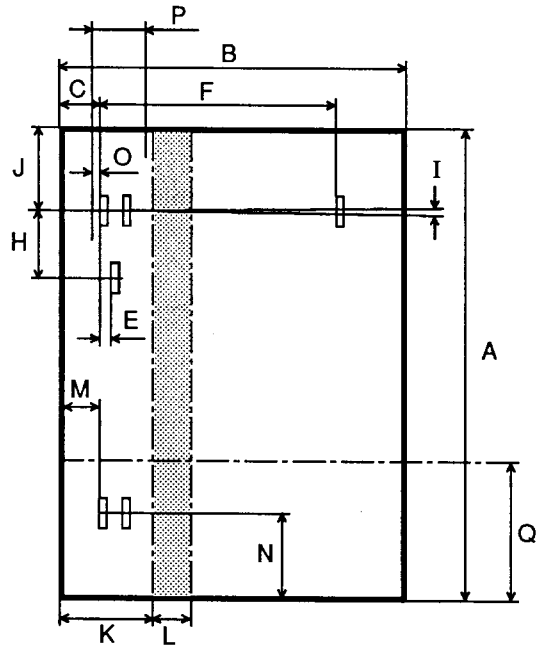
■ Number of Sheets and Paper Weight

Multiple-part forms shall be glued securely only at the top edge to prevent sheet displacement.

<table>
<tr><th>No. of sheets (including an original)</th><th>Top sheet</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>Total thickness</th></tr>
<tr><td>Single-part</td><td>52-80 g/m^2
45-69 kg/ream</td><td>——</td><td>——</td><td>——</td><td>——</td><td>0.065-
0.10 mm
(2.56-
3.94 mil)</td></tr>
<tr><td>2-part</td><td>40-64 g/m^2
34-55 kg/ream</td><td>40-80 g/m^2
34-69 kg/ream</td><td>——</td><td>——</td><td>——</td><td rowspan="4">0.30 mm
(11.81 mil)
max.</td></tr>
<tr><td>3-part</td><td colspan="2">40 g/m^2
34 kg/ream</td><td>40-80 g/m^2
34-69 kg/ream</td><td>——</td><td>——</td></tr>
<tr><td>4-part</td><td colspan="3">40 g/m^2
34 kg/ream</td><td>40-64 g/m^2
34-55 kg/ream</td><td>——</td></tr>
<tr><td>5-part</td><td colspan="5">40 g/m^2
34 kg/ream</td></tr>
</table>

NOTE: g/m^2 : Weight of a sheet of paper 1000 x 1000 mm
kg/ream : Weight of 1000 sheets of duodecimo 788 x 1091 mm

■ Paper Size and Print Area



Symbols **Dimensions**

A ..... 4-14.3 inches (101.6-363.2 mm)
B ..... 4-16.5 inches (101.6-419.1 mm) B:A = 1:0.5 to 1:1.5
C ..... 0-30 mm (This range becomes less if paper width exceeds 15".)
E ..... Vertical character alignment tolerance
- For NLQ 0.10 mm max.
- For Draft 0.20 mm max.
- For High-speed draft 0.30 mm max.

F ..... 342.9 mm (136 chars)
H ..... Line feed pitch tolerance (in 1/6" feed):
- 4.23±0.2 mm/line (single-part forms with 55 kg/ream)
- 4.23±0.5 mm/line (up to 5-part forms with a specified weight other than 55 kg/ream)

Accumulative line feed pitch tolerance: $127^{+1.5}_{-0.5}$mm/30 lines

I ..... 1.5 mm max. (at the last print position on a line)
J ..... 6.35-27.5 mm (setting value ±1 mm)
K ..... 36 mm
L ..... 45 mm (This area shall be white or dropout color with a 70% reflection rate or more. No punch hole is allowed.)
M-C ..... 1.0 mm max. per 5-inch feed, provided that skewing amount (I) is zero and the form is completely rectangular.
N ..... 10.5 mm ± 2 lines (in 1/6" feed pitch)
O..... 5 mm (Measured from the 1st dot position to the left)
P..... 70 mm (Measuring range for the automatic head-adjust feature, based on the left end of range O)
Q..... 24 mm (where line feed accuracy and skewing amount (I) are not assured.)

Notes:

1. The characters will be positioned as shown above when cut forms are automatically loaded by pressing the TOF switch.
2. In the above figure, the vertical distance is based on the 4th dot center of the characters (printed by pin 4 of the print head); the horizontal distance, on the first dot center on the first columns.

4.2 Continuous Forms

■ Number of Sheets and Paper Weight

(1) Single-part forms, carbonless forms, and carbon-backed paper

For rear feed

Layer / No. of sheets	Top sheet	2nd	3rd	4th	5th	6th	Total thickness
Single-part	52-105 g/m^2 45-90 kg/ream	——	——	——	——	——	0.065-0.13 mm (2.56-5.12 mil)
2-part	40-64 g/m^2 35-55 kg/ream	40-80 g/m^2 35-69 kg/ream	——	——	——	——	0.38 mm (14.96 mil) max.
3-part	40-52 g/m^2 35-45 kg/ream		40-80 g/m^2 35-69 kg/ream	——	——	——	
4-part	40-52 g/m^2 35-45 kg/ream			40-56 g/m^2 35-69 kg/ream	——	——	
5-part	40-52 g/m^2 35 kg/ream				40-56 g/m^2 35-48 kg/ream	——	
6-part	40-52 g/m^2 35 kg/ream					40-56 g/m^2 35-48 kg/ream	

For bottom feed

Layer / No. of sheets	Top sheet	2nd	3rd	4th	5th	6th	Total thickness
Single-part	64-128 g/m^2 55-128 kg/ream	——	——	——	——	——	0.08-0.20 mm (3.15-7.87 mil)
2-part	52-64 g/m^2 45-55 kg/ream	40-80 g/m^2 35-69 kg/ream	——	——	——	——	0.45 mm (17.72 mil) max.
3-part	52-64 g/m^2 45-55 kg/ream		40-80 g/m^2 35-69 kg/ream	——	——	——	
4-part	52-64 g/m^2 45-45 kg/ream			40-80 g/m^2 35-69 kg/ream	——	——	
5-part	40-52 g/m^2 35 kg/ream				40-56 g/m^2 35-48 kg/ream	——	
6-part	40-52 g/m^2 35 kg/ream					40-56 g/m^2 35-48 kg/ream	

NOTE: g/m^2 : Weight of a sheet of paper 1000 x 1000 mm
kg/ream : Weight of 1000 sheets of duodecimo 788 x 1091 mm

(2) One-time carbon paper (intermediate layers)

For rear feed

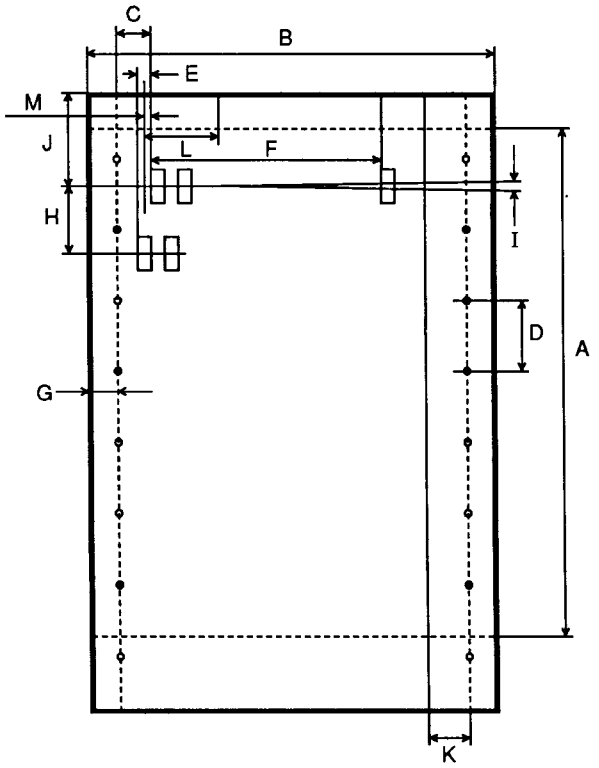
Layer / No. of sheets	Top sheet	2nd	3rd	4th	5th	6th	Total thickness
2-part	35-52 g/m^2 30-45 kg/ream	35-80 g/m^2 30-69 kg/ream	——	——	——	——	0.38 mm (14.96 mil) max. (including carbon paper)
3-part	35-46 g/m^2 30-39.5 kg/ream		35-80 g/m^2 30-69 kg/ream	——	——	——	
4-part	35-46 g/m^2 30-39.5 kg/ream			35-80 g/m^2 30-69 kg/ream	——	——	
5-part	35-46 g/m^2 30-39.5 kg/ream				35-56 g/m^2 30-48 kg/ream	——	
6-part	35-46 g/m^2 30-39.5 kg/ream					35-56 g/m^2 30-48 kg/ream	

For bottom feed

Layer / No. of sheets	Top sheet	2nd	3rd	4th	5th	6th	Total thickness
2-part	35-52 g/m^2 30-45 kg/ream	35-80 g/m^2 30-69 kg/ream	——	——	——	——	0.50 mm (19.69 mil) max. (including carbon paper)
3-part	35-46 g/m^2 30-39.5 kg/ream		35-80 g/m^2 30-69 kg/ream	——	——	——	
4-part	35-46 g/m^2 30-39.5 kg/ream			35-80 g/m^2 30-69 kg/ream	——	——	
5-part	35-46 g/m^2 30-39.5 kg/ream				35-56 g/m^2 30-48 kg/ream	——	
6-part	35-46 g/m^2 30-39.5 kg/ream					35-56 g/m^2 30-48 kg/ream	

NOTE: g/m^2 : Weight of a sheet of paper 1000 x 1000 mm
kg/ream : Weight of 1000 sheets of duodecimo 788 x 1091 mm

■ Paper Size and Print Area



Symbols **Dimensions**

A ..... 11 inches usual (279.4 mm) (integral multiples of one inch)
B ..... 4-16.5 inches (101.6-419.1 mm)
C ..... 6-28 mm (This range becomes less if paper width exceeds 15.5".)
D..... 12.7 mm
E..... Vertical character alignment tolerance
- For NLQ 0.10 mm max.
- For Draft 0.20 mm max.
- For High-speed draft 0.30 mm max.

F ..... 342.9 mm (136 chars)
G ..... 6.35 or 6.00 mm
H ..... Line feed pitch tolerance (in 1/6" feed. Except for one inch from the perforation):
- 4.23±0.2 mm/line (single-part forms with 55 kg/ream)
- 4.23±0.5 mm/line (up to 5-part forms with a specified weight other than 55 kg/ream)

Accumulative line feed pitch tolerance: 42.3±1 mm/10 lines

I ..... 0.8 mm max. (single-part forms) Except for one inch from the
1.3 mm max. (multi-part forms) perforation

J..... 6.35-27.5 mm (setting value ±1 mm)
K ..... 40 mm (where any print and crimp fasteners prohibited)
L ..... 70 mm (Measuring range for the automatic head-adjust feature, based on the left end of range M)
M ..... 5 mm (Measured from the 1st dot position to the left)

Notes:

1. The characters will be positioned as shown above when the horizontal perforation line of the paper is aligned to the paper cutter section.
2. In the above figure, the vertical distance is based on the 4th dot center of the characters (printed by pin 4 of the print head); the horizontal distance, on the first dot center on the first columns.

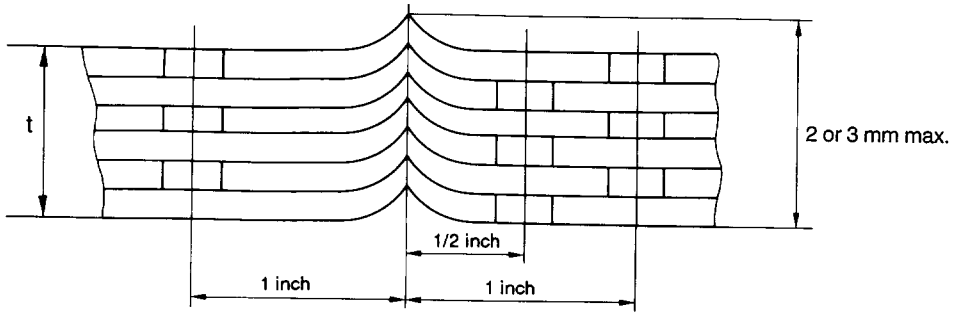
■ Fastening of Multi-part Forms

Multiple-part forms should be fastened with glue or crimp fasteners securely on both sides.

When using multiple-part forms, take the following considerations:

- When the forms are unfolded, the height of the bulge at the outfold should not exceed the following, depending upon the forms' thickness:

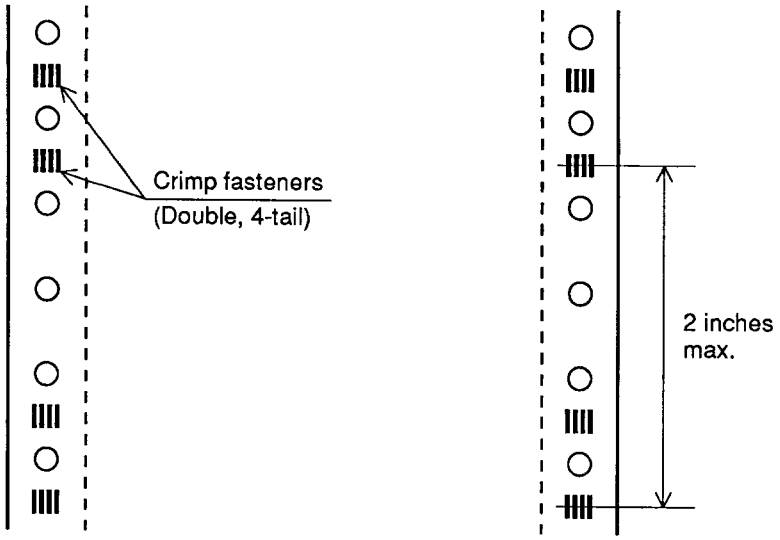
Total thickness (t) of forms	Allowable height of bulge
$t \leq 0.3$ mm	2 mm
$0.3 < t \leq 0.55$ mm	3 mm



This limitation should apply to the multiple-part forms fastened with any method.

- The maximum displacement of the center of the sprocket holes between sheets shall not exceed 0.5 mm.
- Gluing
  a. Spot gluing shall be applied along both sides. It is recommended that spot gluing shall be applied at the alternate positions from the top to bottom sheet.
  b. Glue shall be applied evenly without wrinkling or creasing.
  c. Paper thickness change due to gluing shall not exceed 0.05 mm.
- Crimp fasteners
  a. It is recommended that double crimp fasteners (4-tail) be applied to the same positions on both sides of the forms (see the figure on the next page). Single crimp fasteners (4-tail) are also acceptable.
  b. In consideration of displacement between the top and bottom layers, a spacing of at least 1/3 inch shall be used for form design.
  c. When crimp-fastened forms are used, the cut sheet guide shall be employed.
  d. Displacement between sheets in 5-part forms shall not exceed 2.2 mm in self-print testing.
  e. The combination of gluing on one side and crimp fasteners on the other side is allowed.
  f. When more than 5-part forms are used, apply gluing on one side and crimp fasteners on the other side.

g. The crimp fastener pitch shall be a maximum of 2 inches. When the total thickness of forms is 0.3 mm or less and the paper width is 10 inches or less, a pitch of 3 inches is allowed.



- Metallic fasteners shall not be used.

■ Sprocket Holes and Perforations

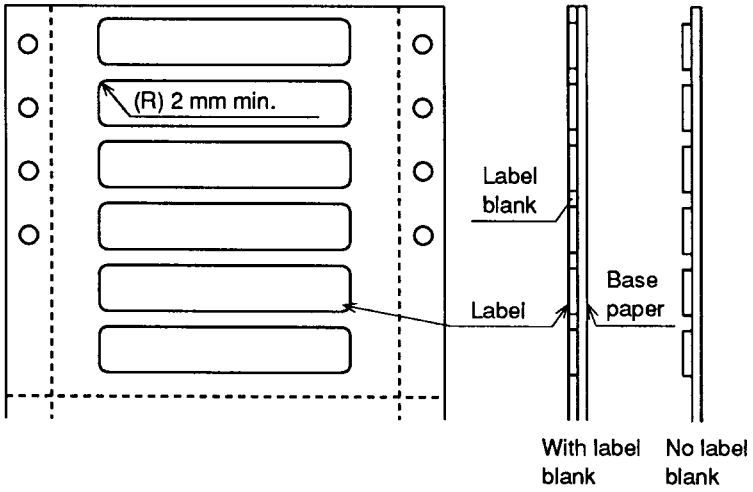
- The sprocket holes shall be clearly and cleanly cut.
- Forms shall be fanfolded at every horizontal perforated line.
- Both edges of each perforation shall not be torn.
- Intersection of the horizontal and vertical perforations shall not be cut.

■ Limitations in Color Printing

- The number of sheets to be copied shall be 5 or less (including an original).
- No color change shall be specified within 1 inch from horizontal perforations.

4.3 Label Forms

■ Paper Size and Print Area



■ Notes

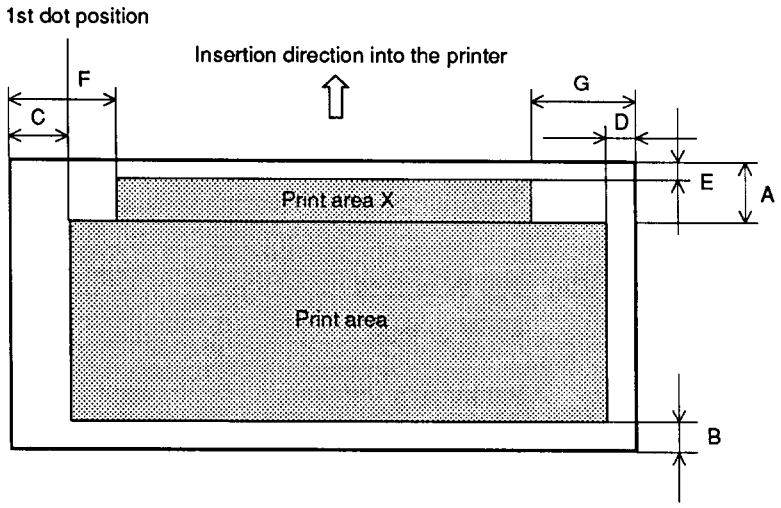
- The total thickness of label and base paper shall not exceed 0.18 mm.
- Label forms shall not be left in the printer.
- The label adhesion shall be so strong that no label comes off or partially separates from the base paper after a label form has been left in the printer for 72 hours at room temperature.
- Label forms without label blank shall not be used in the rear tractor feeder. The optional pull-up tractor feeder (for bottom feeding) can accept label forms both with and without label blank.

  Note that manual head-adjust operation is required before the use of label forms without label blank.
- The temperature range allowable for label printing is from 15° to 35° or from 5° to 35° when the rear tractor feeder or optional pull-up tractor feeder is used, respectively.
- To remove label forms from the printer in the reverse feeding, cut the form along the perforation and rotate the platen knob by hand while taking care not to separate labels from the base paper.

4.4 Envelopes

Ordinary envelopes and air-mail envelopes can be used.

■ Print Area

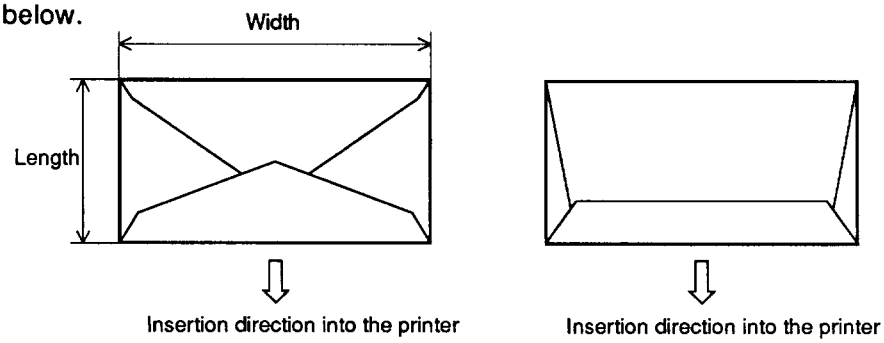


A: 20 mm min.
B: 8 mm min.
C: 20 mm min.
D: 10 mm min.
E: 6.35 mm min.
F: 40 mm min.
G: 40 mm min.

Printing in the NLQ mode only is allowed on print area X.

■ Notes

- Envelopes with windows or punch holes are not allowed.
- Envelopes shall be whitish and have a 70% reflection rate or more.
- No printing is allowed on the back of the envelopes. It is recommended that printing be avoided on the pasted section of the envelopes to prevent them from being stained with ink ribbon.
- Only single-layer envelopes are allowed. (Double-layer ones are not allowed.)
- Envelopes shall be closed and inserted into the printer in the direction shown below.



- Flaps shall have no paste or shall be back-pasted like a postage stamp.
- No paste is allowed except for flaps.
- The temperature range allowable for envelope printing is from 15° to 35°.
- If the platen surface is smudged with paper dust or fragments, clean it with a soft cloth dampened with ethyl alcohol.
- If the printout is smudged with ink ribbon or has dots missing, manually adjust the head-platen gap.

5. POWER REQUIREMENTS AND ENVIRONMENTAL CONDITIONS

5.1 Power Requirements

(1) Source Voltage	115 or 220-240±10% VAC
(2) Frequency	50 or 60±2 Hz
(3) Secondary Output	+5±0.25 VDC +41±2 VDC
(4) Power Consumption	
• Operating (Draft rolling ASCII)	200 W or less
• Idling	40 W or less
(5) AC Line Noise	2.0 kV min. (Measured with output impedance of 50Ω and a pulse width of 100-800 ns.)
(6) Rush Current	40 A max. at the rated voltage and rated frequency
(7) Instantaneous Power Outages	Those of up to 10 ms in duration shall not interfere with the printer operation. Those over 10 ms shall cause RESET operation.
(8) Leakage Current	0.75 mA max.
(9) Insulation Resistance (AC-FG)	10 MΩ min. (with 500 VDC megger)
(10) Dielectric Strength	A 1250 VAC current applied for one minute shall not interfere with the printer operation.
(11) Power Regulation	Transients with levels within the rated voltage±15% and lasting less than 500 ms shall not disrupt or interfere with the printer operation.

5.2 Environmental Conditions

(1) Temperature and Humidity

	Temperature	Humidity
• Operating		
For cut forms and continuous forms	5 to 40°C (41 to 104°F)	30 to 80%
	(Wet bulb temperature shall be less than 27°C or 80.6°F, with no dew condensation.)	
• Storage	-20 to 60°C (-4 to 140°F)	5 to 95%
	(Wet bulb temperature shall be less than 39.2°C or 102.6°F, with no dew condensation.)	

(2) Vibration Resistance

The following test conditions shall not interfere with the printer operation.

• Operating	0.25 G

(3) Electrostatic Noise

Over 10 kV: Malfunction
Over 15 kV: Breakdown

(Measured at all points that the operator is likely to touch while all covers are closed, with the capacitor method with 150 pF capacitor and 150 Ω resistor.)

6. SWITCH PANEL

6.1 General Description

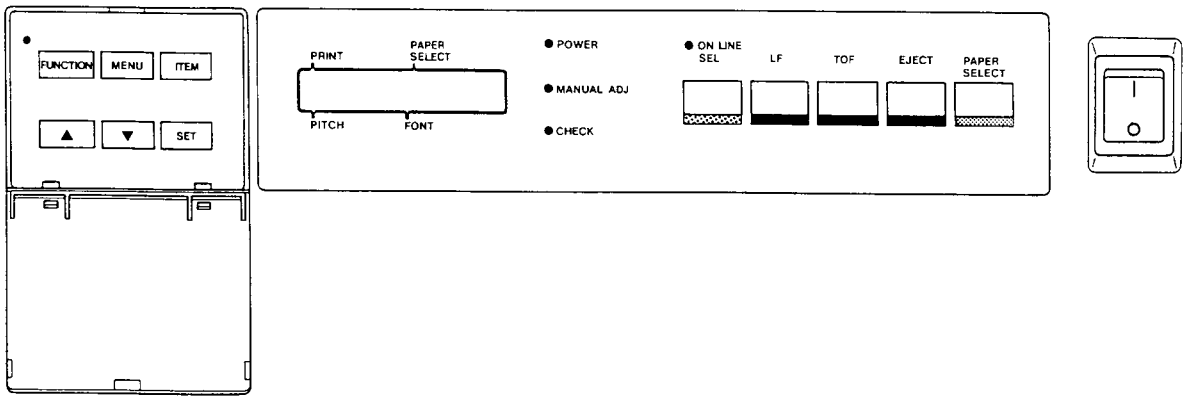
This printer has a versatile switch panel which has the layout shown in the illustration below. It is available in the following three types of modes:

- **Normal Mode** (See Section 6.2.)
- **Function Mode** (See Section 6.3.)
- **Service Modes** (To be used only in the factory or by the service personnel. See Section 6.4.)

With the switch panel placed in the Normal Mode, the user can control the basic printer operations such as switching between online and offline, line feeding, loading/ejecting of paper, and paper loading mode. Settings selected in this mode will not be saved into the printer memory and will be erased when the printer is powered off.

In the Function Mode, the user can select the print quality, character pitch, line feed pitch, font, ribbon type, emulation mode, character set, interface, page length, margins, print attributes, and other various printing conditions. Settings selected in this mode will be saved into the printer's non-volatile memory (EEPROM) as defaults.

The Service Modes (offline and online) allow the personnel to adjust the main PCB setting for the optional mechanisms, head-platen gap, paper cutting position, top-of-form (TOF) position, print start position, vertical character alignment, and ribbon shift amount. In the online Service mode, the setting values can be modified with control commands.



6.2 Normal Mode

(1) POWER switch and POWER lamp (green)

Pressing the "|" side of the POWER switch located on the front side of the printer supplies AC power to the printer and lights the POWER lamp. During the initialization, the "INITIALIZE" appears on the liquid crystal display (LCD).

(2) MANUAL ADJUST lamp (yellow)

This lamp lights when the manual head-adjust feature is selected in the Function mode or when the manual head-adjust gear is rotated while the automatic head-adjust feature is selected on the printer model having the automatic head-adjust mechanism.

(3) CHECK lamp (red)

This lamp lights or flashes if a recoverable or unrecoverable error occurs, respectively.

(4) SEL switch and ON LINE lamp (green)

This switch selects the online or offline mode of the printer. When the POWER switch is turned ON, the printer goes online automatically and the ON LINE lamp comes on, if no error is detected. When the printer is online, it is ready to accept data sent from the computer.

The ON LINE lamp flashes if data remains in the input buffer when the printer is switched from online to offline.

(5) LF (LIne Feed) Switch

Pressing this switch when the ON LINE lamp is off advances the paper by one line at the current line feed pitch. Continued pressure produces continuous feeding.

(6) TOF (Top-of-form) Switch

The function of this switch depends upon the current paper loading mode and whether or not paper has been loaded in the printer. This switch is operational only when the printer is offline.

- Continuous FORMS mode

If no paper is loaded in the printer, a continuous form suspended on the tractor feeder will be fed to the top-of-form position. If paper has been loaded, it will be fed to the next top-of-form position based on the current page length setting.

- Cut SHEET mode

If no paper is loaded, pressing this switch produces no operation. (If the optional cut sheet feeder is connected, a cut sheet in the selected paper tray will be fed into the printer.)

If paper has been set on the sheet guide, it will be fed into the printer. If paper has been loaded in the printer, it will be ejected. (If the optional cut sheet feeder is connected, the printer will eject the loaded paper and feed a new sheet from the selected paper tray into the printer.)

■ BOTTOM feed mode

If no paper is loaded, pressing this switch produces no operation. If paper has been loaded, it will be fed to the next top-of-form position based on the current page length setting.

(7) EJECT switch

The function of this switch depends upon the current paper loading mode and whether or not paper has been loaded in the printer. This switch is operational only when the printer is offline.

■ Continuous FORMS mode

If no paper is loaded in the printer, pressing this switch produces no operation. If paper has been loaded, it will be fed back to the tractor feeder (paper parking function).

■ Cut SHEET mode

Pressing this switch will eject the cut sheet which has been set on the sheet guide or loaded in the printer.

■ BOTTOM feed mode

Pressing this switch produces no operation.

(8) PAPER SELECT switch

Pressing this switch when the ON LINE lamp is off cycles through the following paper loading modes with the corresponding indication on the LCD:

■ Continuous FORMS mode

Loads continuous forms from the rear of the printer with the built-in push tractor feeder.

■ Cut SHEET mode

Loads cut sheets manually or with the optional cut sheet feeder.

■ BOTTOM feed mode

Loads continuous forms from the bottom of the printer with the optional pull-up tractor feeder.

(9) Liquid Crystal Display (LCD)

The LCD is 16 characters wide by 2 characters high. When the POWER switch is turned ON, it shows "INITIALIZE". Upon completion of initialization, it shows the current print quality, paper loading mode, print pitch, and font in the Normal mode.

In the Function mode and the offline Service mode, the LCD shows the menus, items, and settings. In the online Service mode, it shows the "FACTORY ADJUST".

During the self printing or hexadecimal dumping, the LCD shows the "SELF PRINTING XXXX" or "HEX DUMP MODE".

If any error occurs, the corresponding error message will appear on the LCD.

(10) MICRO LINE FEED (▲)

Pressing this switch when the ON LINE lamp is off advances the paper at the specified minimum line feed pitch (1/216"). Continued pressure produces continuous feeding.

(11) MICRO REVERSE LINE FEED (▼)

Pressing this switch when the ON LINE lamp is off reverses the paper at the specified minimum line feed pitch (1/216"). Continued pressure produces continuous reverse feeding.

Special Functions Available by Switch Combination

Turning the POWER switch on while holding down the following switches activates the special functions listed below: For details, see Section 3.11.

SEL	LF	TOF	EJECT	PAPER SELECT	Special Functions
✔					Self-print test (Draft test)
	✔				Self-print test (High-speed draft test)
			✔		Self-print test (All-mode print test)
✔	✔				Hexadecimal dump
✔		✔			Demonstration print
	✔		✔		Revision print
		✔		✔	Quality check print

6.3 Function Mode

6.3.1 Switches, Lamps, and LCD Available In Function Mode

(1) FUNCTION switch and lamp (yellow)

When the POWER switch is turned ON, the FUNCTION lamp is OFF. Pressing this switch when the ON LINE lamp is off turns on this lamp and takes the printer into the Function mode which allows the user to select the various printing conditions.

To restore the printer to the Normal mode, press this switch again.

(2) MENU Switch

Pressing this switch cycles through the following eight menus:

- FONT MENU
- CONTROL MENU
- EMULATE MENU
- INTERFACE MENU
- FORMAT MENU
- PRINT STYLE MENU
- ADJUST HEAD GAP MENU
- RESET FACTORY SET

(3) ITEM Switch

Pressing this switch cycles through the setting items in the menus selected by the MENU switch.

(4) ▼ and ▲ Switches

Pressing the ▼ and ▲ switches scrolls the settings of each item selected by the ITEM switch forward and backward, respectively.

(5) SET Switch

Pressing this switch saves the new setting selected by the MENU, ITEM, ▼ and ▲ switches, into the printer memory (EEPROM). An asterisk appears at the right end of the LCD.

(6) LCD showing the Menu, Items, and Settings

The LCD shows the menus, items, and settings which are changed by pressing the MENU, ITEM, ▲, and ▼ switches.

6.3.2 Operating Procedure

The following procedure describes how to access the Function mode and change the printing conditions. For the detailed description, see Subsection 6.3.3.

(1) Turn the POWER switch on.

(2) Press the SEL switch to change the printer offline.
The ON LINE lamp goes off.

(3) Press the FUNCTION switch.
The FUNCTION lamp comes on and the LCD shows the "FONT MENU".

(4) Press the MENU switch until the desired menu appears on the LCD.

(5) Press the ITEM switch until the desired item appears on the LCD.

(6) Use the ▼ and ▲ switches until the desired setting appears on the LCD.

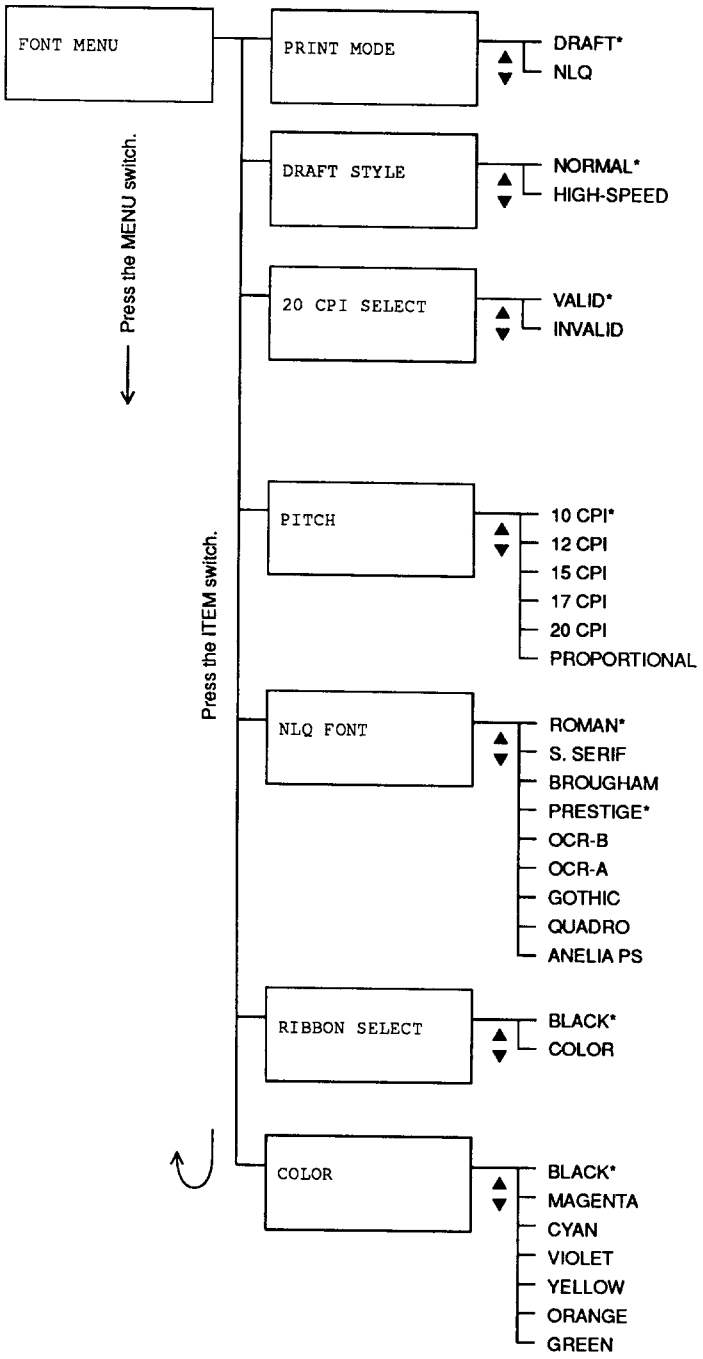
(7) Press the SET switch to save the new setting into the EEPROM. An asterisk will appear at the right end of the LCD to tell that the setting is saved.

(8) Repeat steps (4) through (7), if necessary.

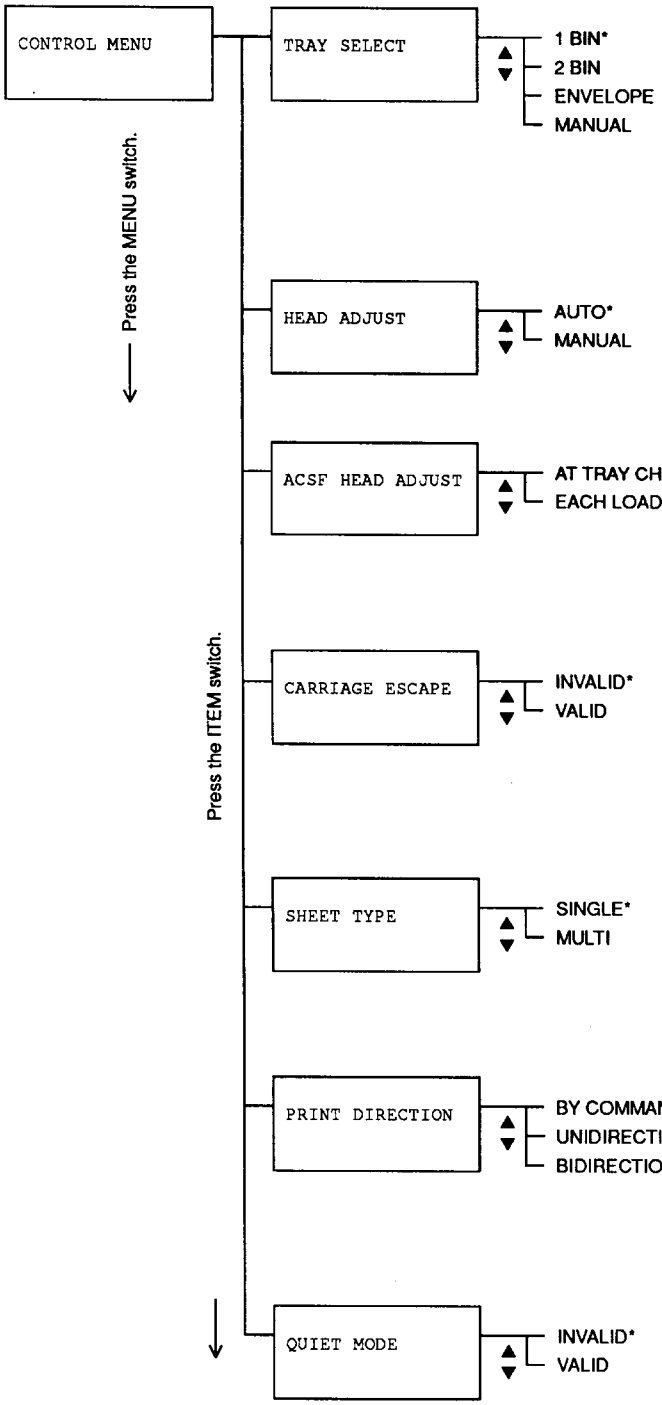
(9) After completing the setting operation, press the FUNCTION switch.
The FUNCTION lamp goes off.

(10) Press the SEL switch to return the printer online for ordinary operation.

6.3.3 Setting Flows in Function Mode


Menus
Items
Settings
Descriptions
FONT MENU
Press the MENU switch.
Press the ITEM switch.
PRINT MODE
DRAFT*
NLQ
Selects the print quality: Draft or near-letter quality (NLQ).
DRAFT STYLE
NORMAL*
HIGH-SPEED
Selects the normal draft or High-speed draft. In the normal draft mode, the printer can print at 600 cps (pica); in the high-speed draft mode, at 800 cps (pica).
20 CPI SELECT
VALID*
INVALID
Activates or deactivates the 20-cpi function.
This item is available only in the IBM-emulation mode. If this function is activated, the 20 cpi pitch selected from the switch panel or with command will be effective. If it is deactivated, the 20 cpi pitch is not available, even if selected, and the printer prints at 12 cpi.
PITCH
10 CPI*
12 CPI
15 CPI
17 CPI
20 CPI
PROPORTIONAL
Selects the print pitch.
In the IBM-emulation mode, the 20-cpi pitch will be effective only when the 20-cpi function is activated in "20 CPI SELECT" menu. If the 20-cpi function is deactivated, the printer prints at 12 cpi.
NLQ FONT
ROMAN*
S. SERIF
BROUGHAM
PRESTIGE*
OCR-B
OCR-A
GOTHIC
QUADRO
ANELIA PS
Selects NLQ font.
Be sure to select the NLQ print in "PRINT MODE" menu before actual printing.
RIBBON SELECT
BLACK*
COLOR
Selects ribbon type: 1-inch wide black or color ribbon cassette.
If the printer supports no color printing, this item will not appear on the LCD.
COLOR
BLACK*
MAGENTA
CYAN
VIOLET
YELLOW
ORANGE
GREEN
Selects color band.
This item is available only when the color ribbon is selected in "RIBBON SELECT" menu.
If the printer supports no color printing, this item will not appear on the LCD.

Menus	Items	Settings	Descriptions



Selects the paper source when the optional cut sheet feeder (CSF) is installed.
1 BIN: From the 1st bin of the feeder.
2 BIN: From the 2nd bin of the feeder.
ENVELOPE: From the envelope bin of the feeder.
MANUAL: Directly into the printer by hand.

This item is available only when the optional CSF is connected. If no CSF is connected, this item will not appear on the LCD.

Activates or deactivates the automatic head-adjust function.

This item is available only when the printer is equipped with the auto head-adjust mechanism.

Selects the head-adjust timing when the optional CSF is connected: at the timing when the bin (or tray) of the feeder is changed or every time a sheet is loaded.

This item is available only when the automatic head-adjust function is activated in 'HEAD ADJUST" menu.

Activates or deactivates the carrier escape function, a function which moves the carrier one inch to the left from its home position before paper feeding every one print line to prevent the crimp fasteners from being broken due to the carrier.

This item is available only when the FORMS or BOTTOM mode is selected.

Selects the single- or multi-part cut sheets.

If MULTI is selected, the printer automatically opens the paper bail slightly each time paper advances for the specified amount.

This item is available only when the SHEET mode is selected.

Selects the printing direction.

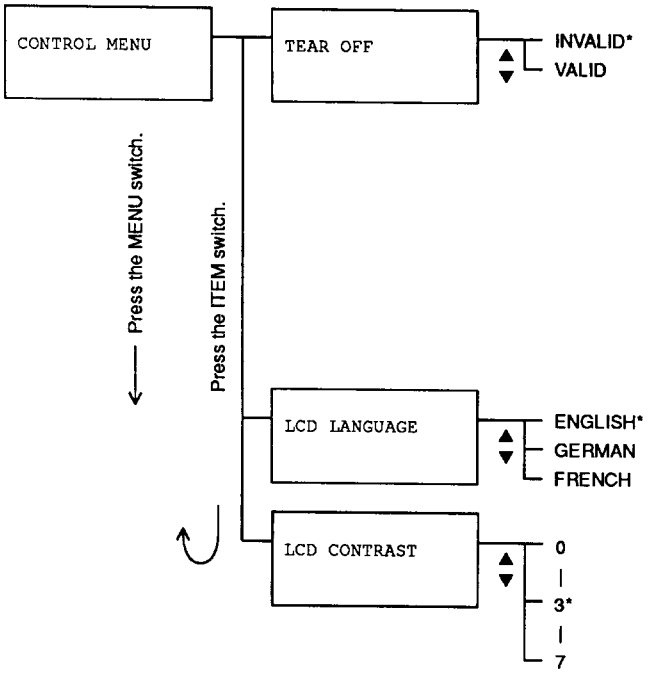
If the UNIDIRECTIONAL print is selected, one-line data of the IBM graphics characters, vertically-enlarged characters, bit images, and others are split into two and printed unidirectionally in two passes. Note that the normal alphanumeric characters are always printed bidirectionally.

Selects quiet printing.

If VALID is set, the printer prints at half speed, reducing the print noise.

This item is not available in NLQ mode.

Menus	Items	Settings	Descriptions



Activates or deactivates the tear-off function.

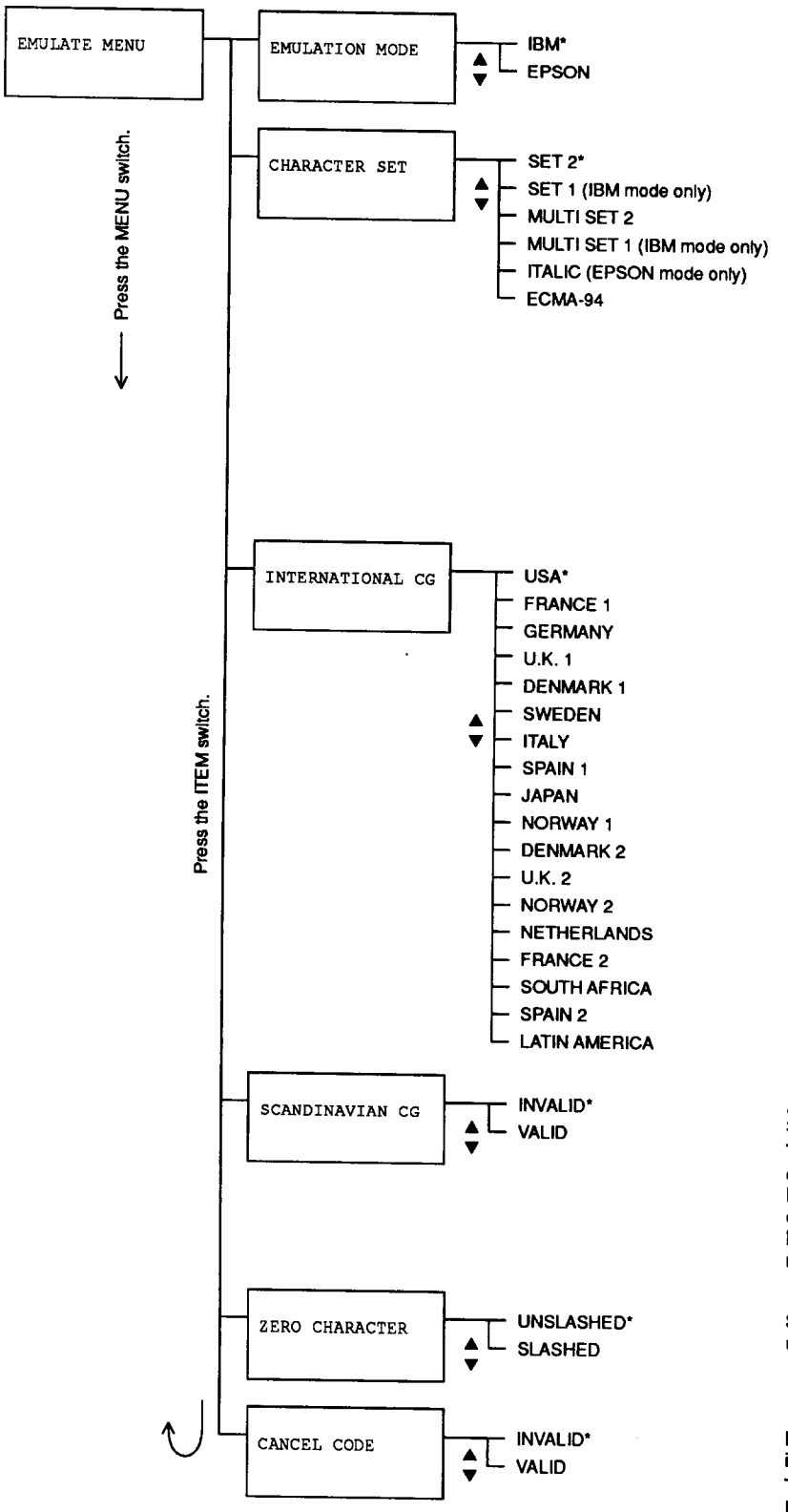
If the tear-off function is activated, the printer automatically feeds continuous forms upon receipt of an FF command or TOF switch panel command until the tear-off position (horizontal perforation) is aligned with the paper cutter. After the user tears off the paper, the printer feeds the paper back to the top-of-form position of the page when it receives print data.

The factory default distance between the tear-off position and the top-of-form position is 13/12". To print more than or less than the default distance, change the FIRST PRINT LINE / FORMS in "FORMAT" menu.

Selects the language of the messages to be shown on the LCD.

Selects the contrast level of the LCD within the range from 0 to 7.

Menus	Items	Settings	Descriptions



Selects the emulation mode: IBM Proprinter III XL or Epson FX-1050 printer.

Selects the character set.

Only the character sets available in the selected emulation mode will appear on the LCD.

If the Epson-emulation mode is switched to the IBM-emulation mode with command after ITALIC is selected, the LCD retains the ITALIC indication but the USA SET 2 is actually applied.

If the IBM-emulation mode is switched to the Epson-emulation mode with command after the USA SET1 or MULTI SET 2 is selected, the LCD retains the corresponding indication but the USA SET 2 is actually applied.

Selects the national character set.

This item is available only when the italics or graphics character set has been selected in the Epson-emulation mode.

Activates or deactivates the Scandinavian CG.

This item is available when any of the character sets except ECMA-94 has been set in the IBM-emulation mode or when any graphics character set has been set in the Epson-emulation mode.

Selects zero font: slashed (Ø) or unslashed (0).

Makes cancel code CAN valid or invalid.

This item is effective only when the IBM-emulation mode is selected.

If INVALID is set, the printer ignores cancel codes if received.

Menus	Items	Settings	Descriptions

Selects interface: Centronics parallel or RS-232C serial.

If this signal function is set to INVALID, the DC1 and DC3 commands are always ignored. If it is set to VALID and the SLCT IN signal is High, the printer ignores receive data following a DC3 and preceding a DC1. If the SLCT IN is Low, the printer ignores DC1 and DC3 codes.

This item is available only when the Epson-emulation mode is selected in the parallel interface operation.

Selects the baud rate for the serial interface operation.

This item is available only in the serial interface operation.

Selects the data length for the serial interface operation: 8 bits or 7 bits per data.

This item is available only in the parallel interface operation.

Activates or deactivates the parity check function for the serial interface operation.

This item is available only in the serial interface operation.

Selects the communications protocol for the serial interface operation: Data Terminal Ready (DTR) or X-ON/X-OFF.

This item is available only in the serial interface operation.

Selects the stop bit length for data transmission from the printer to the host.

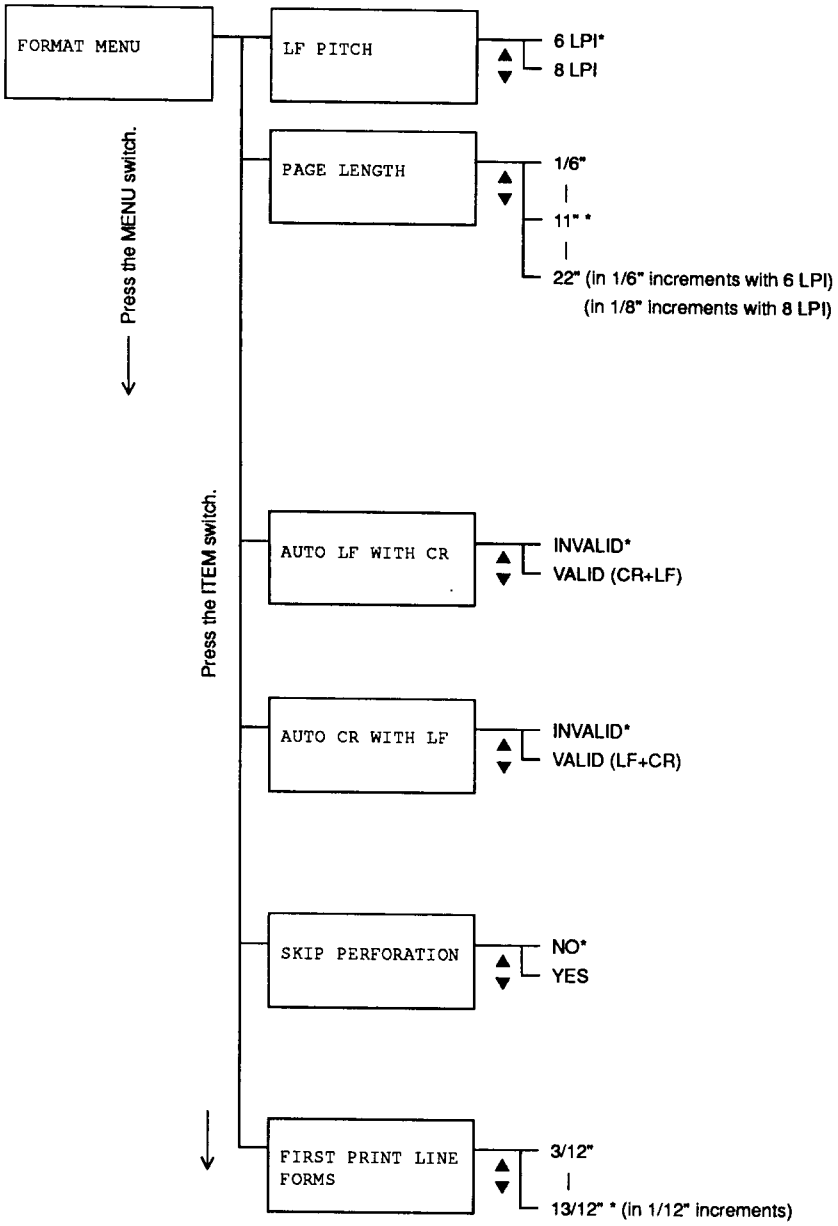
This item is available only in the serial interface operation.

Activates or deactivates the input buffer.

If the printer has a 128-kilobyte buffer, LCD shows 128K instead of 32K.

Pressing the SET switch while the LCD shows this item clears data in the input, print, and image buffers.

Menus	Items	Settings	Descriptions



Selects the line feed pitch (lines per inch).

Sets the page length in inches: 1/6" through 22" in increments of 1/6". (1/8" through 22" in increments of 1/8" if the line feed pitch is set to 8 LPI.)

If the page length is changed, the printer regards the current paper position as a TOF position and cancels the skip perforation function.

If the line feed pitch is changed after the page length setting, the increment switches to the new pitch.

Activates or deactivates the AUTO LF function.

If this function is set to VALID, a CR command causes a carriage return followed by a line feed operation.

Activates or deactivates the AUTO CR function.

If this function is set to VALID, an LF-related command causes a line feed and a carriage return.

This item is available only in the IBM-emulation mode.

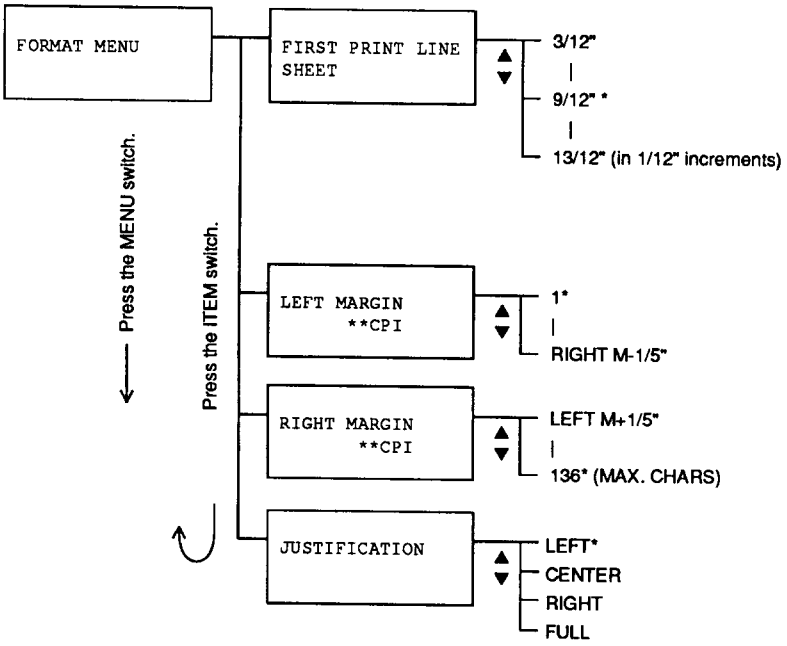
Activates or deactivates the skip perforation function, a function which skips one-inch area on both sides of horizontal perforations.

Most application programs control the same function, so it may not be necessary to turn on this setting.

Adjusts the first print line (the distance from the top edge of a page to the 4th pin position of the print head) from 3/12" to 13/12" in 1/12" increments for continuous forms.

Pressing the TOF switch or inputting a form-feed command feeds the paper up to the selected first print line position.

Menus	Items	Settings	Descriptions



Adjusts the first print line (the distance from the top edge of paper to the 4th pin position of the print head) from 3/12" to 13/12" in 1/12" increments for cut sheets.

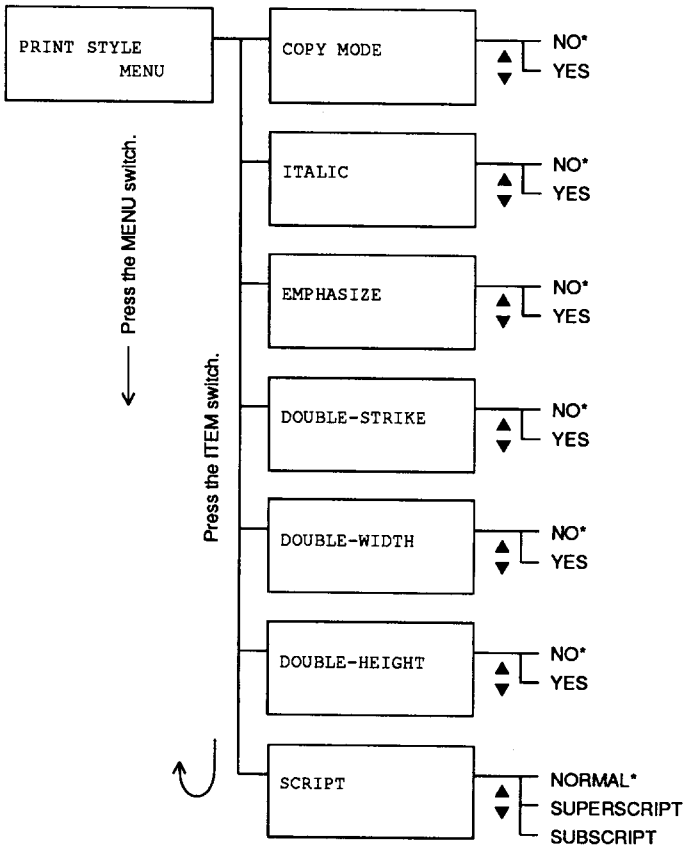
Pressing the TOF switch or inputting a form-feed command feeds the paper up to the selected first print line position.

Sets the left margin at the *n*th column in the current character pitch: 1 through (right margin - 1).

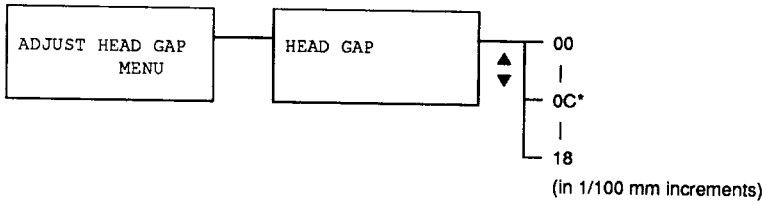
Sets the right margin at the *n*th column in the current character pitch: (left margin + 1/5") through 136.

Selects the justification type: Flush left, centered, flush right, or justified.

Menus	Items	Settings	Descriptions



Menus	Items	Settings	Descriptions



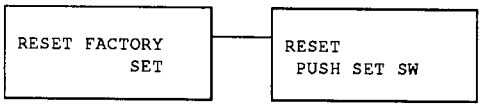
Adjusts the gap between the print head and the platen.

This adjustment is required only when the print head is replaced with a new one on the printer having the automatic head-adjust mechanism.

Remove paper from the printer and set the code of the head nose length printed on the new print head.

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [2], (B) and (D).

Menus	Items	Settings	Descriptions



Pressing the SET switch while the LCD shows this item resets the printer and restores all the settings in the EEPROM to the factory defaults.

6.4 Service Modes

6.4.1 Offline Service Mode

6.4.1.1 Switches, lamps, and LCD available in offline Service mode

(1) FUNCTION, ITEM, and EJECT switches

Turning the POWER switch on while holding down the FUNCTION, ITEM, and EJECT switches takes the printer into the Service mode which allows the service personnel to access and change the factory defaults.

To restore the printer to the Normal mode, turn the POWER switch off and on.

(2) MENU Switch

Pressing this switch cycles through the following eight menus:

- OPTION SELECT
- ADJUST HEAD GAP
- ADJUST PAPER CUT POSITION
- ADJUST TOP OF PAPER POSITION
- ADJUST FIRST COLUMN
- ADJUST VERTICAL ALIGNMENT
- ADJUST RIBBON POSITION
- DEFAULT SETTING

(3) ITEM Switch

Pressing this switch cycles through the setting items in the menus selected by the MENU switch.

(4) ▼ and ▲ Switches

Pressing the ▼ and ▲ switches scrolls the settings of each item selected by the ITEM switch forward and backward, respectively.

(5) SET Switch

Pressing this switch saves the new setting selected by the MENU, ITEM, ▼ and ▲ switches, into the printer memory (EEPROM). An asterisk appears at the right end of the LCD.

(6) LCD showing the Menu, Items, and Settings

The LCD shows the menus, items, and settings which are changed by pressing the MENU, ITEM, ▲, and ▼ switches.

6.4.1.2 Operating procedure

The following procedure describes how to access the offline Service mode and adjust the printing conditions. For the detailed description, see Subsection 6.4.1.3 and Chapter III, Section 4.

(1) Turn on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp flashes and the LCD shows the "OPTION SELECT".

(2) Press the MENU switch until the desired menu appears on the LCD.

(3) Press the ITEM switch until the desired item appears on the LCD.

(4) Use the ▼ and ▲ switches until the desired setting appears on the LCD.

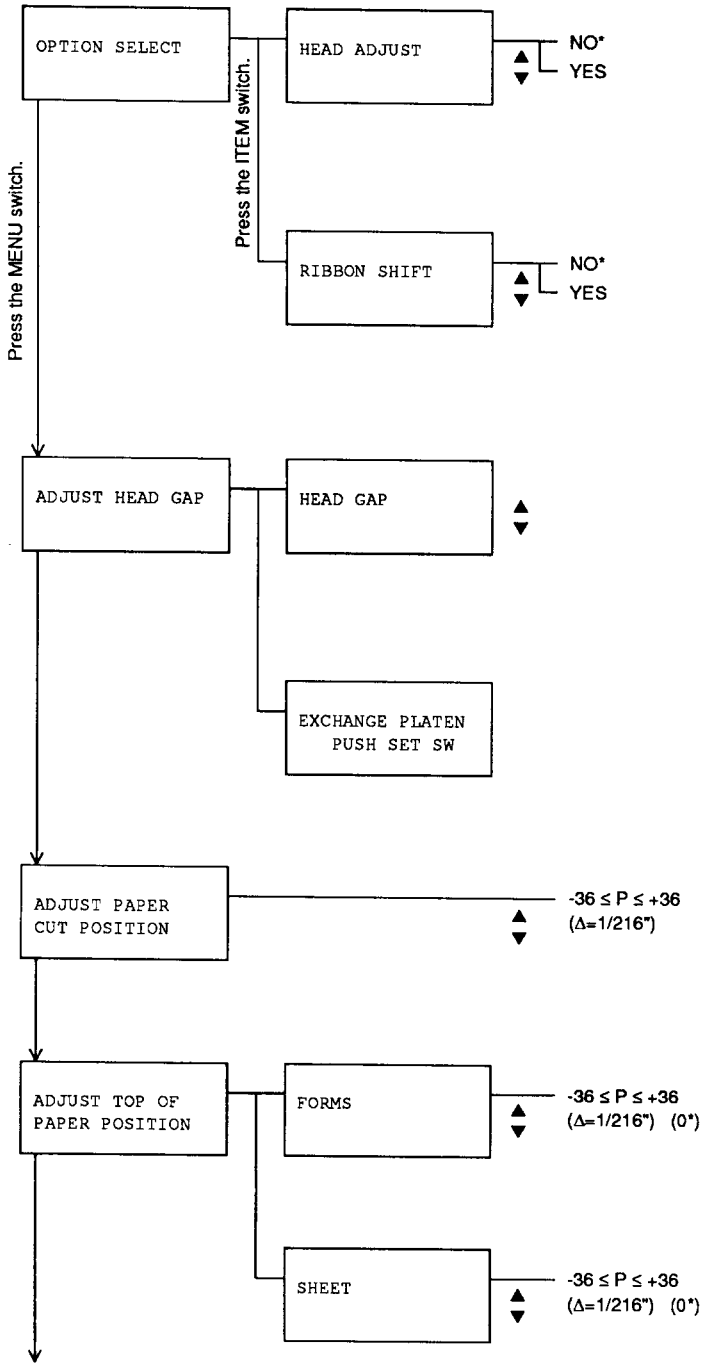
(5) Press the SET switch to save the new setting into the EEPROM. An asterisk will appear at the right end of the LCD to tell that the setting is saved.

(6) Repeat steps (2) through (5), if necessary.

(7) After completing the setting operation, turn off the POWER switch.

6.4.1.3 Setting flow in offline Service mode

NOTE: The Service mode is intended for the service personnel only and should be used only to set up a new main PCB or mechanical parts after the service personnel have replaced those parts.



Selects or deselects the optional automatic head-adjust mechanism depending upon whether the printer is equipped with the mechanism or not.

If the printer is equipped with the automatic head-adjust mechanism, select YES.

For details, refer to Chapter III, Subsection 4.1.2, [1].

Selects or deselects the optional ribbon shift mechanism depending upon whether the printer is equipped with the mechanism or not.

If the printer is equipped with the ribbon shift mechanism, select YES.

For details, refer to Chapter III, Subsection 4.1.2, [1].

Adjusts the gap between the print head and the platen.

This adjustment is required when the carrier or the EEPROM on the main PCB is replaced with a new one.

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [2], (A).

Compensates for individual differences in platens.

This adjustment is required when the platen is replaced with a new one.

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [2], (C).

Adjusts the paper feed amount in increments of 1/216" for the tear-off position in the continuous forms mode in order to align the perforation with the paper cutter.

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [3].

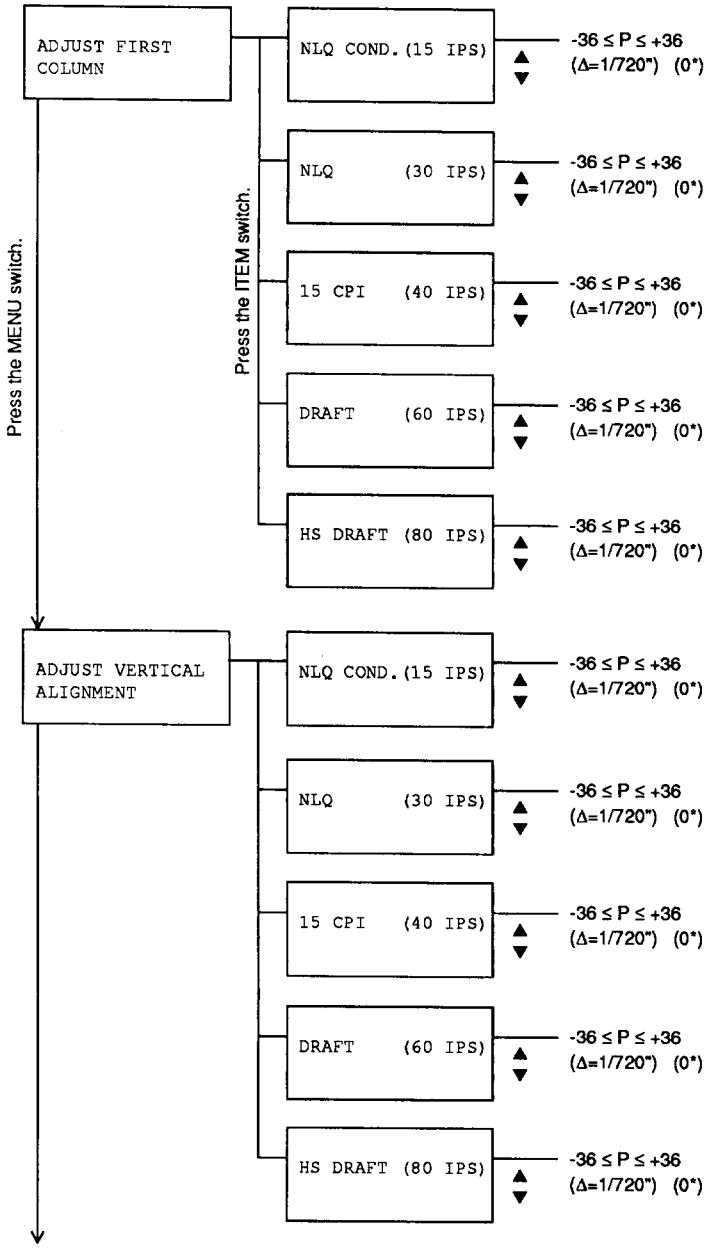
Adjusts the top-of-form position (the distance from the top edge of a page to the 4th pin position of the print head) in increments of 1/216" for continuous forms.

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [4].

Adjusts the top-of-form position (the distance from the top edge of paper to the 4th pin position of the print head) in increments of 1/216" for cut sheets.

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [4].

Menus	Items	Settings	Descriptions


Press the MENU switch.
ADJUST FIRST COLUMN
Press the ITEM switch.
NLQ COND. (15 IPS)
NLQ (30 IPS)
15 CPI (40 IPS)
DRAFT (60 IPS)
HS DRAFT (80 IPS)
-36 ≤ P ≤ +36 (Δ=1/720") (0")
ADJUST VERTICAL ALIGNMENT
NLQ COND. (15 IPS)
NLQ (30 IPS)
15 CPI (40 IPS)
DRAFT (60 IPS)
HS DRAFT (80 IPS)
-36 ≤ P ≤ +36 (Δ=1/720") (0")

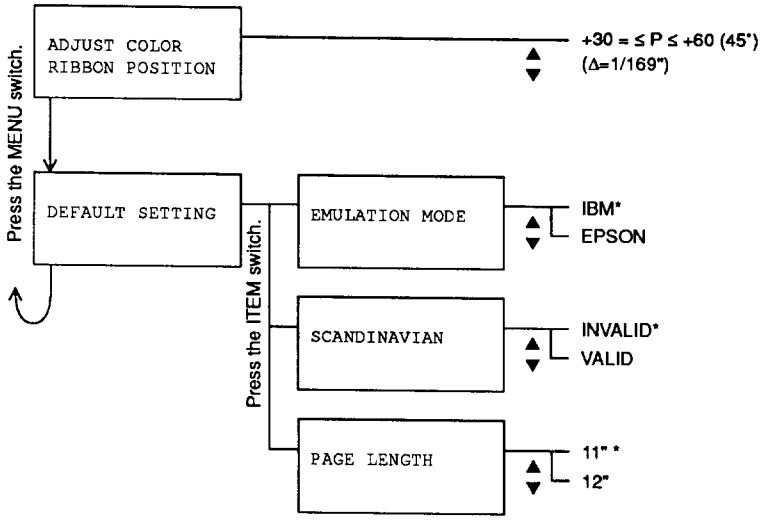
Adjusts the first column or the print start position in each of the five printing modes: the condensed NLQ, NLQ, 15 cpi, draft, and high-speed draft modes, in increments of 1/720".

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [5].

Adjusts the vertical alignment for print characters in bidirectional printing in each of the five printing modes: the condensed NLQ, NLQ, 15 cpi, draft, and high-speed draft modes, in increments of 1/720".

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [6].

Menus	Items	Settings	Descriptions



Adjusts the ribbon shift amount for clear color printing, in increments of 1/169".

For the detailed procedure, refer to Chapter III, Subsection 4.1.2, [7].

Sets the default of the emulation mode.

Sets the default of the Scandinavian CG setting.

Sets the default of the page length.

6.4.2 Online Service Mode

The online Service mode allows the personnel to adjust the part of the same setting as those in the offline Service mode and the Function mode, using control commands from the host computer.

The following procedure describes how to access the online Service mode. For the detailed description, refer to Chapter III, Section 4.2.

(1) Turn on the POWER switch while holding down the FUNCTION, ITEM, and PAPER SELECT switches.
The FUNCTION lamp flashes and the LCD shows the "FACTORY ADJUST".

(2) Set the desired setting value to be written into the printer's EEPROM, with the following command format:

C P1 P2 CR (0DH)

C: Adjustment code
P1, P2: Parameters

	Adjustment items	Command format
(1)	Optional feature setting	89H P1 P2 CR
(2)	Head-platen gap	85H P1 P2 CR
(3)	Paper cutting position	87H P1 CR
(4)	Top-of-form position	81H P1 P2 CR
(5)	Print start position	88H P1 P2 CR
(6)	Vertical character alignment in bidirectional printing	80H P1 P2 CR
(7)	Ribbon shift amount	86H P1 CR
(8)	Emulation selection	82H P1 CR
(9)	Scandinavian CG	83H P1 CR
(10)	Format selection	84H P1 CR

If "C" is out of the specification, the printer will immediately terminate the online Service mode.

If a value entered for "P1" or "P2" is out of the specification, the printer ignores the received bytes relating the adjustment code.

Upon receipt of CR code, the printer adjusts the corresponding item and saves the adjustment value into the non-volatile memory (EEPROM).

7. CONTROL COMMANDS

The printer responds to the following control codes and sequences.

7.1 IBM-emulation Mode

Command	Function	Value in Hex.
BS	Backspace	08
HT	Horizontal TAB	09
LF	Line Feed	0A
VT	Vertical TAB	0B
FF	Form Feed	0C
CR	Carriage Return	0D
SO (Shift-out)	Double-width Character Mode (One Line Only)	0E
SI (Shift-in)	Condensed Character Mode	0F
DC1 (Device Control 1)	Select Printer	11
DC2 (Device Control 2)	Set Pica Pitch	12
DC4 (Device Control 4)	Cancel Double-width Character Mode Set by SO or ESC SO	14
CAN	Clear Printer Buffer	18
ESC SO	Double-width Character Mode (One Line Only)	1B 0E
ESC EM *n*	Control Optional Cut Sheet Feeder	1B 19 *n*
ESC ! *n*	Change Print Mode Parameters	1B 21 *n*
ESC * *m* n_1 n_2	Select Bit Image Mode	1B 2A *m* n_1 n_2
ESC - *n*	Activated/Deactivate Underline Function	1B 2D *n*
ESC 0	1/8" Line Spacing	1B 30
ESC 1	7/72" Line Spacing	1B 31
ESC 2	Start Line Spacing Mode Set by ESC A	1B 32
ESC 3 *n*	Set *n*/216" Line Spacing	1B 33 *n*
ESC 4	Set Top-of-form Position	1B 34
ESC 5 *n*	Switch AUTO CR ON/OFF	1B 35 *n*
ESC 6	Select Character Set II	1B 36
ESC 7	Select Character Set I	1B 37
ESC 8	Disable PE Sensor	1B 38
ESC 9	Enable PE Sensor	1B 39
ESC :	Set Elite Pitch	1B 3A
ESC <	Set Left-to-right Print (One line only)	1B 3C
ESC = n_1 n_2 23 m_1 m_2	Define 9-pin Downloaded Characters	1B 3D n_1 n_2 23 m_1 m_2

Command	Function	Value in Hex.
ESC ? *n m*	Change Bit Image Density	1B 3F
ESC A *n*	Set Line Spacing to *n*/72" or *n*/60"	1B 41 *n*
ESC B n_1 ... n_k NUL	Set Vertical TAB Stops	1B 42 n_1 ... n_k 00
ESC C *n*	Set Page Length (No. of lines)	1B 43 *n*
ESC C 0 *n*	Set Page Length (in inches)	1B 43 00 *n*
ESC D n_1 ... n_k NUL	Set Horizontal TAB Stops	1B 44 n_1 ... n_k 00
ESC E	Emphasized Character Mode	1B 45
ESC F	Cancel Emphasized Character Mode	1B 46
ESC G	Double-strike Character Mode	1B 47
ESC H	Cancel Double-strike Character Mode	1B 48
ESC I *n*	Select Font and Print Quality	1B 49 *n*
ESC J *n*	Execute (*n*/216") Line Spacing	1B 4A *n*
ESC K n_1 n_2	Single-density Bit Image Mode	1B 4B n_1 n_2
ESC L n_1 n_2	Double-density Bit Image Mode	1B 4C n_1 n_2
ESC N *n*	Skip-over Perforation	1B 4E *n*
ESC O	Cancel Skip-over Perforation	1B 4F
ESC P *n*	Set/Cancel Proportional Spacing	1B 50 *n*
ESC Q 3 or 22	Deselect Printer	1B 51 3 or 22
ESC R	Restore to Default TAB Settings	1B 52
ESC S *n*	Super-/Subscript Print Mode	1B 53 *n*
ESC T	Cancel Super-/Subscript Print Mode	1B 54
ESC U *n*	Select Unidirectional/Bidirectional Print	1B 55 *n*
ESC W *n*	Set/Cancel Double-width Character Mode	1B 57 *n*
ESC X n_1 n_2	Set Right and Left Margins	1B 58 n_1 n_2
ESC Y n_1 n_2	Double-speed & Double-density Bit Image Mode	1B 59 n_1 n_2
ESC Z n_1 n_2	Quadruple-density Bit Image Mode	1B 5A n_1 n_2
ESC [@ n_1 n_2 m_1 m_2 m_3 m_4	Double-height & Double-width Character Mode	1B 5B 40 n_1 n_2 m_1 m_2 m_3 m_4
ESC [K n_1 n_2 m_1 m_2 m_3 m_4	Initialize Printer	1B 5B 4B n_1 n_2 m_1 m_2 m_3 m_4
ESC \ n_1 n_2	Print Characters from All Character Table	1B 5C n_1 n_2
ESC]	Execute 1 Line Buck LF	1B 5D

Command	Function	Value in Hex.
ESC ^	Print Single Character from All Character Table	1B 5E
ESC _ *n*	Activate/Deactivate Overline Function	1B 5F *n*
ESC b	Select Black Ribbon	1B 62
ESC c	Select Cyan Ribbon	1B 63
ESC d n_1 n_2	Move to Relative Position (*n*/120")	1B 64 n_1 n_2
ESC e	Change Emulation	1B 65
ESC f	Execute Auto-head Adjustment	1B 66
ESC g	Set 15 cpi Pitch	1B 67
ESC h *n*	Select Draft or High-speed Draft Mode	1B 68 *n*
ESC i *n* .... *n*	Print Bar Codes or Expanded Characters	1B 69 *n* .... *n*
ESC j	Stop Printing	1B 6A
ESC k *n*	Select NLQ Font	1B 6B *n*
ESC m	Select Magenta Ribbon	1B 6D
ESC q *n*	Set/Cancel Outline and Shadow Print Modes	1B 71 *n*
ESC s *n*	Set/Cancel Half-speed Mode	1B 73 *n*
ESC u *n*	Set/Cancel Copy Mode	1B 75 *n*
ESC x *n*	Select Print Quality	1B 78 *n*
ESC y	Select Yellow Ribbon	1B 79

7.2 Epson-emulation Mode

Command	Function	Value in Hex.
BS	Backspace	08
HT	Horizontal TAB	09
LF	Line Feed	0A
VT	Vertical TAB	0B
FF	Form Feed	0C
CR	Carriage Return	0D
SO (Shift-out)	Double-width Character Mode (One Line Only)	0E
SI (Shift-in)	Condensed Character Mode	0F
DC1 (Device Control 1)	Select Printer	11
DC2 (Device Control 2)	Cancel Condensed Character Mode	12
DC3 (Device Control 3)	Deselect Printer	13
DC4 (Device Control 4)	Cancel Double-width Character Mode Set by SO or ESC SO	14
CAN	Clear Printer Buffer	18
ESC SO	Double-width Character Mode (One Line Only)	1B 0E
ESC SI	Condensed Character Mode	1B 0F
ESC EM *n*	Control Optional Cut Sheet Feeder	1B 19 *n*
ESC SP *n*	Add Character Space	1B 20 *n*
ESC ! *n*	Change Print Mode Parameters	1B 21 *n*
ESC #	Cancel MSB Control	1B 23
ESC $ n_1 n_2	Absolute Dot Position	1B 24 n_1 n_2
ESC % *n*	Select Internal/Downloaded Characters	1B 25 *n*
ESC & NUL n m a	Define 9-pin Downloaded Characters (in Draft mode)	1B 26 00 n m a
ESC & NUL *n m* a_0 a_1 a_2	Define 9-pin Downloaded Characters (in NLQ mode)	1B 26 00 *n m* a_0 a_1 a_2
ESC (- n_1 n_2 *m* d_1 d_2	Select Score (Single, double, or dotted)	1B 28 2D n_1 n_2 *m* d_1 d_2
ESC * *m* n_1 n_2	Select Bit Image Mode	1B 2A *m* n_1 n_2
ESC - *n*	Activate/Deactivate Underline Function	1B 2D *n*
ESC / *n*	Select Vertical Format Unit (VFU) Channel	1B 2F *n*
ESC 0	Set 1/8" Line Spacing	1B 30
ESC 1	Select 7/72" Line Spacing	1B 31
ESC 2	Set 1/6" Line Spacing	1B 32

Command	Function	Value in Hex.
ESC 3 *n*	Set *n*/216" Line Spacing	1B 33 *n*
ESC 4	Set Italic Mode	1B 34
ESC 5	Cancel Italic Mode	1B 35
ESC 6	Expand Printable Character Code Area	1B 36
ESC 7	Cancel Expansion of Printable Character Code Area	1B 37
ESC 8	Disable PE Sensor	1B 38
ESC 9	Enable PE Sensor	1B 39
ESC : NUL *n s*	Copy Internal Characters to Download Buffer	1B 3A 00 *n s*
ESC <	Set Left-to-right Print Mode (One Line Only)	1B 3C
ESC =	Set MSB 0	1B 3D
ESC >	Set MSB 1	1B 3E
ESC ? *n m*	Change Bit Image Density	1B 3F *n m*
ESC @	Initialize Printer	1B 40
ESC A *n*	Set *n*/72" Line Spacing	1B 41 *n*
ESC B n_1 ... n_k NUL	Set Vertical TAB Stops	1B 42 n_1 ... n_k 00
ESC C *n*	Set Page Length (No. of lines)	1B 43 *n*
ESC C NUL *n*	Set Page Length (In inches)	1B 43 00 *n*
ESC D n_1 ... n_k NUL	Set Horizontal TAB Stops	1B 44 n_1 ... n_k 00
ESC E	Emphasized Character Mode	1B 45
ESC F	Cancel Emphasized Character Mode	1B 46
ESC G	Double-strike Character Mode	1B 47
ESC H	Cancel Double-strike Character Mode	1B 48
ESC I *n*	Expand Printable Character Code Area	1B 49 *n*
ESC J *n*	Execute *n*/216" Line Spacing	1B 4A *n*
ESC K n_1 n_2	Set Single-density Bit Image Mode	1B 4B n_1 n_2
ESC L n_1 n_2	Set Double-density Bit Image Mode	1B 4C n_1 n_2
ESC M	Set Elite Pitch	1B 4D
ESC N *n*	Set Skip-over Perforation	1B 4E *n*
ESC O	Cancel Skip-over Perforation	1B 4F
ESC P	Set Pica Pitch	1B 50

Command	Function	Value In Hex.
ESC Q *n*	Set Right Margin	1B 51 *n*
ESC R *n*	Select National Character Set	1B 52 *n*
ESC S *n*	Set Super-/Subscript Print Mode	1B 53 *n*
ESC T	Cancel Super-/Subscript Print Mode	1B 54
ESC U *n*	Set/Cancel Unidirectional Printing	1B 55 *n*
ESC W *n*	Set/Cancel Double-width Character Mode	1B 57 *n*
ESC Y n_1 n_2	Set Double-speed/Double-density Bit Image Mode	1B 59 n_1 n_2
ESC Z n_1 n_2	Set Quadruple-density Bit Image Mode	1B 5A n_1 n_2
ESC \ n_1 n_2	Set Relative Dot Position	1B 5C n_1 n_2
ESC ^ a n_1 n_2	Select 9-pin Bit Image Mode	1B 5E a n_1 n_2
ESC a *n*	Select Justification	1B 61 *n*
ESC b *n* m_1 ... m_k NUL	Set Vertical TAB Stops in Specified VFU Channel	1B 62 *n* m_1 ... m_k 00
ESC e	Change Emulation	1B 65
ESC f	Execute Auto-head Adjustment	1B 66
ESC g	Set 15 cpi Pitch	1B 67
ESC h *n*	Select Draft or High-speed Draft Mode	1B 68 *n*
ESC i *n* ... *n*	Print Bar Codes or Expanded Characters	1B 69 *n* ... *n*
ESC k *n*	Select NLQ Font	1B 6B *n*
ESC ℓ *n*	Set Left Margin	1B 6C *n*
ESC p *n*	Set/Cancel Proportional Spacing	1B 70 *n*
ESC r *n*	Select Color Printing	1B 72 *n*
ESC s *n*	Set/Cancel Half-speed Mode	1B 73 *n*
ESC t *n*	Select Character Table	1B 74 *n*
ESC u *n*	Set/Cancel Copy Mode	1B 75 *n*
ESC w *n*	Set/Cancel Double-height Character Mode	1B 77 *n*
ESC x *n*	Select Printing Quality	1B 78 *n*
DEL	Delete Last Character from Print Buffer	7F

8. CHARACTER SET TABLES

8.1 IBM-compatible

(1) Character Set I

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0		SP 32	0 48	@ 64	P 80	` 96	p 112	NUL 128	144	á 160	▒ 176	└ 192	╨ 208	α 224	≡ 240
1	0001		DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	í 161	▓ 177	┴ 193	╤ 209	ß 225	± 241
2	0010		DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	DC2 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011		19	# 35	3 51	C 67	S 83	c 99	s 115	131	147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100		DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101		21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110		22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111		23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	BS 136	CAN 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	EM 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	• 249
A	1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	VT 139	ESC 155	½ 171	╗ 187	╦ 203	▉ 219	δ 235	√ 251
C	1100	FF 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	FF 140	156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252
D	1101	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	¡ 173	╜ 189	═ 205	▌ 221	ϕ 237	2 253
E	1110	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	SO 142	158	« 174	╛ 190	╬ 206	▐ 222	ε 238	■ 254
F	1111	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	127	SI 143	159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

Scandinavian Characters

HEX. CODE											
9B	9D	9E	9F	A6	A7	A9	AA	AB	AC	AE	AF
ø	Ø	Ŀ	ŀ	ō	Ō	ã	Ã	ℓ	ħ	³	¤

(2) Character Set II

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	176	192	208	α 224	≡ 240
1	0001	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	177	193	209	ß 225	± 241
2	0010	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	178	194	210	Γ 226	≥ 242
3	0011	♥ 3	19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	179	195	211	π 227	≤ 243
4	0100	♦ 4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	180	196	212	Σ 228	⌠ 244
5	0101	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	181	197	213	σ 229	⌡ 245
6	0110	♠ 6	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	182	198	214	µ 230	÷ 246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	183	199	215	τ 231	≈ 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	184	200	216	Φ 232	° 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	185	201	217	Θ 233	• 249
A	1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	186	202	218	Ω 234	· 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	187	203	219	δ 235	√ 251
C	1100	FF 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	188	204	220	∞ 236	n 252
D	1101	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	189	205	221	φ 237	2 253
E	1110	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	« 174	190	206	222	ε 238	■ 254
F	1111	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	127	Å 143	ƒ 159	» 175	191	207	223	∩ 239	SP 255

For Scandinavian Characters, refer to Section 8.1 (1).

(3) All-character Code Set

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ø 0	▶ 16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	☺ 1	◀ 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	■ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	☻ 2	↕ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	♥ 3	‼ 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	♦ 4	¶ 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111	• 7	↨ 23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	1000	◘ 8	↑ 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	○ 9	↓ 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	∙ 249
A	1010	◙ 10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	♂ 11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	1100	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252
D	1101	♪ 13	↔ 29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	ϕ 237	² 253
E	1110	♫ 14	▲ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	ε 238	■ 254
F	1111	☼ 15	▼ 31	/ 47	? 63	O 79	_ 95	o 111	⌂ 127	Å 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

For Scandinavian Characters, refer to Section 8.1 (1).

(4) Multilingual Character Set I

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	NUL 128	144	á 160	▒ 176	└ 192	ð 208	ó 224	- 240
1	0001	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	í 161	▓ 177	┴ 193	Đ 209	ß 225	± 241
2	0010	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	DC2 146	ó 162	▓ 178	┬ 194	Ê 210	ô 226	‗ 242
3	0011	3	19	# 35	3 51	C 67	S 83	c 99	s 115	131	147	ú 163	┃ 179	├ 195	Ë 211	ò 227	¾ 243
4	0100	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	Ñ 165	Á 181	┼ 197	ı 213	ð 229	§ 245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	ª 166	Â 182	ã 198	ÍÎ 214	µ 230	÷ 246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	º 167	À 183	Ã 199	Ï 215	Þ 231	¸ 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	BS 136	CAN 152	¿ 168	© 184	╚ 200	┘ 216	Ý 232	° 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	EM 153	® 169	╣ 185	╔ 201	┌ 217	ú 233	¨ 249
A	1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	¬ 170	║ 186	╩ 202	█ 218	Û 234	· 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	VT 139	ESC 155	½ 171	╗ 187	╦ 203	▌ 219	ù 235	¹ 251
C	1100	FF 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	FF 140	156	¼ 172	╝ 188	╠ 204	▄ 220	ý 236	³ 252
D	1101	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	¡ 173	¢ 189	═ 205	¦ 221	Ý 237	² 253
E	1110	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	SO 142	158	« 174	¥ 190	╬ 206	ì 222	¯ 238	■ 254
F	1111	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	127	SI 143	159	» 175	┐ 191	¤ 207	▀ 223	´ 239	SP 255

For Scandinavian Characters, refer to Section 8.1 (1).

(5) Multilingual Character Set II

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	ð 208	ó 224	- 240
1	0001	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▓ 177	┴ 193	Đ 209	ß 225	± 241
2	0010	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	Ê 210	Ô 226	‗ 242
3	0011	♥ 3	19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	Ë 211	Ò 227	¾ 243
4	0100	♦ 4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244
5	0101	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	Á 181	┼ 197	ı 213	Õ 229	§ 245
6	0110	♠ 6	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	Â 182	ã 198	í 214	µ 230	÷ 246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	À 183	Ã 199	Î 215	þ 231	¸ 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	© 184	╚ 200	Ï 216	Þ 232	° 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	® 169	╣ 185	╔ 201	┘ 217	Ú 233	¨ 249
A	1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Û 234	· 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	ø 155	½ 171	╗ 187	╦ 203	▓ 219	Ù 235	¹ 251
C	1100	FF 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▓ 220	ý 236	³ 252
D	1101	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	Ø 157	¡ 173	¢ 189	═ 205	¦ 221	Ý 237	² 253
E	1110	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	× 158	« 174	¥ 190	╬ 206	Ì 222	¯ 238	■ 254
F	1111	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	127	Å 143	ƒ 159	» 175	┐ 191	¤ 207	▓ 223	´ 239	SP 255

For Scandinavian Characters, refer to Section 8.1 (1).

(6) Multilingual, All-character Code Set

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ø 0	▶ 16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	ð 208	ó 224	- 240
1	0001	☺ 1	◀ 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▓ 177	┴ 193	Ð 209	ß 225	± 241
2	0010	☻ 2	↕ 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	Ê 210	ô 226	‗ 242
3	0011	♥ 3	‼ 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	▌ 179	├ 195	Ë 211	ò 227	¾ 243
4	0100	♦ 4	¶ 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244
5	0101	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	Á 181	┼ 197	ı 213	Õ 229	§ 245
6	0110	♠ 6	▬ 22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	Â 182	ã 198	í 214	µ 230	÷ 246
7	0111	• 7	↨ 23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	À 183	Ã 199	Í 215	þ 231	¸ 247
8	1000	◘ 8	↑ 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	© 184	╚ 200	Î 216	Þ 232	° 248
9	1001	○ 9	↓ 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	® 169	╣ 185	╔ 201	Ï 217	Ú 233	¨ 249
A	1010	◙ 10	→ 26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Û 234	· 250
B	1011	♂ 11	← 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	ø 155	½ 171	╗ 187	╦ 203	▒ 219	Ù 235	¹ 251
C	1100	♀ 12	∟ 28	, 44	< 60	L 76	\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	ý 236	³ 252
D	1101	♪ 13	↔ 29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	Ø 157	¡ 173	¢ 189	═ 205	¦ 221	Ý 237	² 253
E	1110	♫ 14	▲ 30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	× 158	« 174	¥ 190	╬ 206	Ì 222	¯ 238	■ 254
F	1111	☼ 15	▼ 31	/ 47	? 63	O 79	_ 95	o 111	⌂ 127	Å 143	ƒ 159	» 175	┐ 191	¤ 207	▀ 223	´ 239	SP 255

For Scandinavian Characters, refer to Section 8.1 (1).

(7) ECMA-94 Character Set

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0	16	SPC 32	0 48	@ 64	P 80	` 96	p 112	128	144	160	° 176	À 192	Ð 208	à 224	ð 240
1	0001	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	145	¡ 161	± 177	Á 193	Ñ 209	á 225	ñ 241
2	0010	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	146	¢ 162	² 178	Â 194	Ò 210	â 226	ò 242
3	0011	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	131	147	£ 163	³ 179	Ã 195	Ó 211	ã 227	ó 243
4	0100	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	148	¤ 164	´ 180	Ä 196	Ô 212	ä 228	ô 244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	¥ 165	µ 181	Å 197	Õ 213	å 229	õ 245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	¦ 166	¶ 182	Æ 198	Ö 214	æ 230	ö 246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	§ 167	· 183	Ç 199	× 215	ç 231	÷ 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	136	152	¨ 168	¸ 184	È 200	Ø 216	è 232	ø 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	137	153	© 169	¹ 185	É 201	Ù 217	é 233	ù 249
A	1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	138	154	ª 170	º 186	Ê 202	Ú 218	ê 234	ú 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	139	155	« 171	» 187	Ë 203	Û 219	ë 235	û 251
C	1100	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	140	156	¬ 172	¼ 188	Ì 204	Ü 220	ì 236	ü 252
D	1101	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	141	157	173	½ 189	Í 205	Ý 221	í 237	ý 253
E	1110	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	142	158	® 174	¾ 190	Î 206	Þ 222	î 238	þ 254
F	1111	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	■ 127	143	159	¯ 175	¿ 191	Ï 207	ß 223	ï 239	ÿ 255

8.2 Epson-compatible

8.2.1 Italic Character Set

(1) U.S.A.

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0		SP 32	0 48	@ 64	P 80	` 96	p 112	NUL 128		SP 160	*0* 176	*@* 192	*P* 208	` 224	*p* 240
1	0001		DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113		DC1 145	*!* 161	*1* 177	*A* 193	*Q* 209	*a* 225	*q* 241
2	0010		DC2 18	" 34	2 50	B 66	R 82	b 98	r 114		DC2 146	*"* 162	*2* 178	*B* 194	*R* 210	*b* 226	*r* 242
3	0011		DC3 19	# 35	3 51	C 67	S 83	c 99	s 115		DC3 147	*#* 163	*3* 179	*C* 195	*S* 211	*c* 227	*s* 243
4	0100		DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116		DC4 148	*$* 164	*4* 180	*D* 196	*T* 212	*d* 228	*t* 244
5	0101			% 37	5 53	E 69	U 85	e 101	u 117			*%* 165	*5* 181	*E* 197	*U* 213	*e* 229	*u* 245
6	0110			& 38	6 54	F 70	V 86	f 102	v 118			*&* 166	*6* 182	*F* 198	*V* 214	*f* 230	*v* 246
7	0111			' 39	7 55	G 71	W 87	g 103	w 119			*'* 167	*7* 183	*G* 199	*W* 215	*g* 231	*w* 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	BS 136	CAN 152	*(* 168	*8* 184	*H* 200	*X* 216	*h* 232	*x* 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	EM 153	*)* 169	*9* 185	*I* 201	*Y* 217	*i* 233	*y* 249
A	1010	LF 10		* 42	: 58	J 74	Z 90	j 106	z 122	LF 138		*** 170	*:* 186	*J* 202	*Z* 218	*j* 234	*z* 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	VT 139	ESC 155	*+* 171	*;* 187	*K* 203	*[* 219	*k* 235	*{* 251
C	1100	FF 12		, 44	< 60	L 76	\ 92	l 108	¦ 124	FF 140		*,* 172	*<* 188	*L* 204	** 220	*l* 236	*¦* 252
D	1101	CR 13		- 45	= 61	M 77	] 93	m 109	} 125	CR 141		*-* 173	*=* 189	*M* 205	*]* 221	*m* 237	*}* 253
E	1110	SO 14		. 46	> 62	N 78	^ 94	n 110	~ 126	SO 142		*.* 174	*>* 190	*N* 206	*^* 222	*n* 238	*~* 254
F	1111	SI 15		/ 47	? 63	O 79	_ 95	o 111	DEL 127	SI 143		*/* 175	*?* 191	*O* 207	*_* 223	*o* 239	DEL 255

This page shows the character set for the U.S.A. Specific characters in each France, Germany, United Kingdom, Denmark, Sweden, Italy, Spain, Japan, Norway, and Latin America are shown on the following two pages.

(2) Other 17 Countries

	HEX. CODE											
	23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
■ France I	#	$	à	°	ç	§	^	`	é	ù	è	¨
■ Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
■ United Kingdom I	£	$	@	[	\	]	^	`	{	¦	}	~
■ Denmark I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
■ Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
■ Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì
■ Spain I	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
■ Japan	#	$	@	[	¥	]	^	`	{	¦	}	~
■ Norway I	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
■ Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
■ Spain II	#	$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
■ Latin America	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú
■ United Kingdom II	#	£	@	[	\	]	^	`	{	¦	}	~
■ Norway II	£	$	§	Æ	Ø	Å	^	`	æ	ø	å	¨
■ France II	#	â	à	î	ç	ê	û	ô	é	ú	è	ï
■ South Africa	#	ê	É	Ê	Ö	è	Ü	é	ë	ö	ô	ü
■ Netherlands	#	$	@	[	]	ƒ	^	`	é	ij	è	¨

8.2.2 Graphics Character Set

(1) U.S.A.

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▓ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	∙ 249
A	1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	▓ 219	δ 235	√ 251
C	1100	FF 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252
D	1101	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	ϕ 237	2 253
E	1110	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	ε 238	■ 254
F	1111	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	DEL 127	Å 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

This page shows the character set for the U.S.A. Specific characters in each France, Germany, United Kingdom, Denmark, Sweden, Italy, Spain, Japan, Norway, and Latin America are shown in Subsection 8.2.1, (2).
For Scandinavian Characters, refer to Section 8.1 (1).

8.2.3 Multilingual Graphics Character Set

(1) U.S.A.

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	ð 208	ó 224	- 240
1	0001	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▓ 177	┴ 193	Đ 209	ß 225	± 241
2	0010	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	Ê 210	Ô 226	‗ 242
3	0011	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	Ë 211	Ò 227	¾ 243
4	0100	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244
5	0101	5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	Á 181	┼ 197	ı 213	Õ 229	§ 245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	Â 182	ã 198	í 214	µ 230	÷ 246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	À 183	Ã 199	Î 215	þ 231	¸ 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	© 184	╚ 200	Ï 216	Þ 232	° 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	® 169	╣ 185	╔ 201	┘ 217	Ú 233	¨ 249
A	1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Û 234	· 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	ø 155	½ 171	╗ 187	╦ 203	▒ 219	Ù 235	¹ 251
C	1100	FF 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▒ 220	ý 236	³ 252
D	1101	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	Ø 157	¡ 173	¢ 189	═ 205	¦ 221	Ý 237	² 253
E	1110	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	× 158	« 174	¥ 190	╬ 206	Ì 222	¯ 238	■ 254
F	1111	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	DEL 127	Å 143	ƒ 159	» 175	┐ 191	¤ 207	■ 223	´ 239	SP 255

This page shows the character set for the U.S.A. Specific characters in each France, Germany, United Kingdom, Denmark, Sweden, Italy, Spain, Japan, Norway, and Latin America are shown in Subsection 8.2.1, (2).

For Scandinavian Characters, refer to Section 8.1 (1).

8.2.4 ECMA-94 Character Set

Upper 4 Bits / Lower 4 Bits	Hex No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Hex. No.	Binary No.	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	NUL 0	16	SPC 32	0 48	@ 64	P 80	` 96	p 112	128	144	160	° 176	À 192	Ð 208	à 224	ð 240
1	0001	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	145	¡ 161	± 177	Á 193	Ñ 209	á 225	ñ 241
2	0010	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	146	¢ 162	² 178	Â 194	Ò 210	â 226	ò 242
3	0011	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	131	147	£ 163	³ 179	Ã 195	Ó 211	ã 227	ó 243
4	0100	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	148	¤ 164	´ 180	Ä 196	Ô 212	ä 228	ô 244
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	¥ 165	µ 181	Å 197	Õ 213	å 229	õ 245
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	¦ 166	¶ 182	Æ 198	Ö 214	æ 230	ö 246
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	§ 167	· 183	Ç 199	× 215	ç 231	÷ 247
8	1000	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	136	152	¨ 168	¸ 184	È 200	Ø 216	è 232	ø 248
9	1001	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121	137	153	© 169	¹ 185	É 201	Ù 217	é 233	ù 249
A	1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	138	154	ª 170	º 186	Ê 202	Ú 218	ê 234	ú 250
B	1011	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	139	155	« 171	» 187	Ë 203	Û 219	ë 235	û 251
C	1100	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	140	156	¬ 172	¼ 188	Ì 204	Ü 220	ì 236	ü 252
D	1101	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	141	157	173	½ 189	Í 205	Ý 221	í 237	ý 253
E	1110	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	142	158	® 174	¾ 190	Î 206	Þ 222	î 238	þ 254
F	1111	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	DEL 127	143	159	¯ 175	¿ 191	Ï 207	ß 223	ï 239	ÿ 255

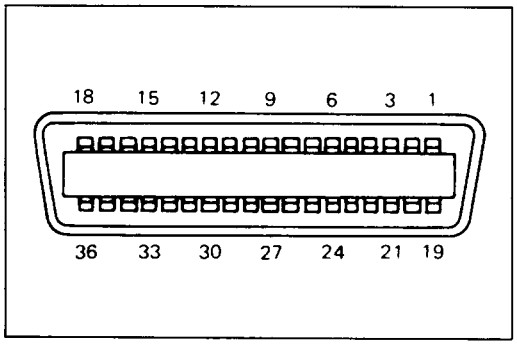
9. INTERFACE SPECIFICATIONS

9.1 Centronics Parallel Interface

(1) Interface Connectors

Printer Side : Amphenol 57LE-40360 or equivalent
Cable Side : Amphenol 57FE-30360 or equivalent
Cable Length : 2 m (6.5 feet) max.

Shielded cable (twisted pair cable) shall be used.



(2) Pin Assignment

Pin No.	Signal	Pin No.	Signal
1	$\overline{\text{DATA STROBE}}$	19	0 V (S.G.)
2	DATA 1	20	
3	DATA 2	21	
4	DATA 3	22	
5	DATA 4	23	
6	DATA 5	24	
7	DATA 6	25	
8	DATA 7	26	
9	DATA 8	27	
10	$\overline{\text{ACKNLG}}$	28	
11	BUSY	29	
12	PE	30	
13	SLCT (See Note.)	31	$\overline{\text{INPUT PRIME}}$
14	$\overline{\text{AUTO FEED}}$	32	$\overline{\text{FAULT}}$
15	Not used.	33	0 V (S.G.)
16	0 V (S.G.)	34	Not used.
17	0 V (F.G.)	35	Not used.
18	+5 V	36	$\overline{\text{SLCT IN}}$

Note: The SLCT signal of pin 13 is fixed at high level in the Epson-emulation mode.

(3) Signal Description

Pin No.	Signal Name	IN/OUT	Explanation
1	$\overline{\text{DATA STROBE}}$	IN	Data reading strobe pulse whose minimum width shall be 1 μs. High in steady state. Data is read on the leading edge of this signal going High.
2-9	DATA 1-8	IN	Bit 1 through bit 8 of the data. The level is High for 1 and Low for 0. The minimum width shall be 3 μs.
10	$\overline{\text{ACKNLG}}$	OUT	Acknowledge pulse that is outputted upon completion of data input or upon completion of printer operation. The pulse width is approx. 5 μs.
11	BUSY	OUT	Signal to indicate if the printer is ready for data reception. When this signal is Low, the printer can accept data. This signal goes High under any of the following conditions: – During printer operation – During data input – In offline (DESELECT) state
12	PE	OUT	DC level signal that goes High when the paper empty state is detected.
13	SLCT	OUT	High when the printer is selected; Low, when deselected.
14	$\overline{\text{AUTO FEED}}$	IN	When this signal goes Low, the printer automatically feeds paper by one line after printing.
18	+ 5 V Source	OUT	Power supply line for +5 V. Max. 50 mA
31	$\overline{\text{INPUT PRIME}}$	IN	When this signal goes Low, the printer is reset to the initial state. The minimum pulse width is 100 μs.
32	$\overline{\text{FAULT}}$	OUT	DC level signal that goes Low when the printer is offline.
36	$\overline{\text{SLCT IN}}$	IN	When this signal is High, control codes DC1 and DC3 can control the printer.

(3) Signal Description

Pin No.	Signal Name	IN/OUT	Explanation
1	$\overline{\text{DATA STROBE}}$	IN	Data reading strobe pulse whose minimum width shall be 1 µs. High in steady state. Data is read on the leading edge of this signal going High.
2-9	DATA 1-8	IN	Bit 1 through bit 8 of the data. The level is High for 1 and Low for 0. The minimum width shall be 3 µs.
10	$\overline{\text{ACKNLG}}$	OUT	Acknowledge pulse that is outputted upon completion of data input or upon completion of printer operation. The pulse width is approx. 5 µs.
11	BUSY	OUT	Signal to indicate if the printer is ready for data reception. When this signal is Low, the printer can accept data. This signal goes High under any of the following conditions: – During printer operation – During data input – In offline (DESELECT) state
12	PE	OUT	DC level signal that goes High when the paper empty state is detected.
13	SLCT	OUT	High when the printer is selected; Low, when deselected.
14	$\overline{\text{AUTO FEED}}$	IN	When this signal goes Low, the printer automatically feeds paper by one line after printing.
18	+ 5 V Source	OUT	Power supply line for +5 V. Max. 500 mA
31	$\overline{\text{INPUT PRIME}}$	IN	When this signal goes Low, the printer is reset to the initial state. The minimum pulse width is 100 µs.
32	$\overline{\text{FAULT}}$	OUT	DC level signal that goes Low when the printer is offline.
36	$\overline{\text{SLCT IN}}$	IN	When this signal is High, control codes DC1 and DC3 can control the printer.

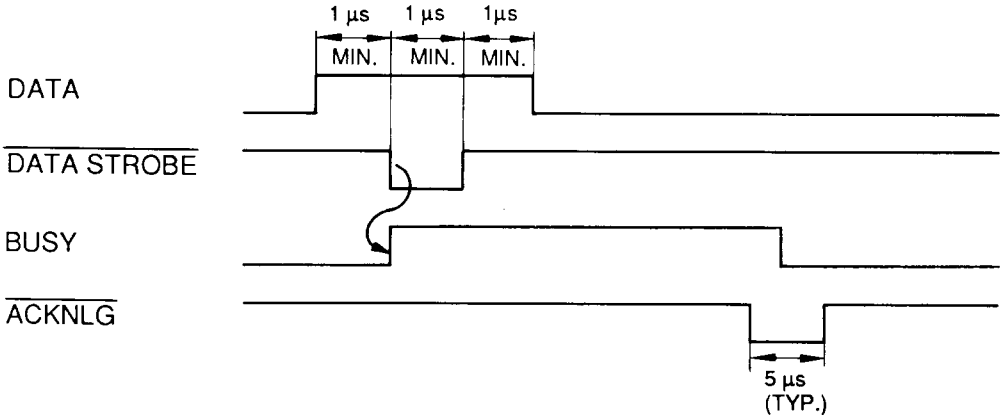
(4) Interface Circuitry

Signals of the interface line are compatible to TTL level. The input and output levels are as follows at TTL I/O pins.

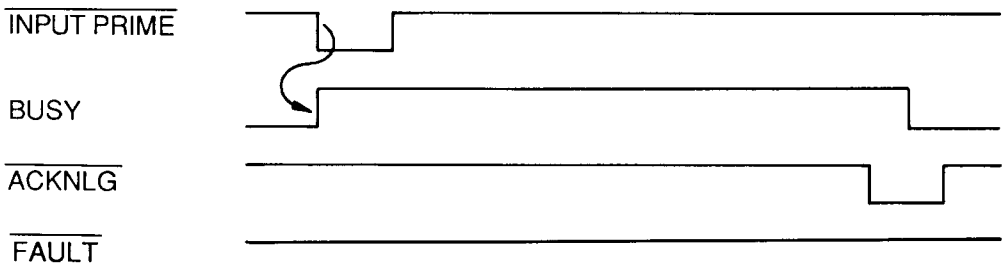
	LOW level (V)	HIGH level (V)
Input	$0 \leq V \leq 0.4$	$2.4 \leq V \leq 5.0$
Output	$0 \leq V \leq 0.4$	$2.4 \leq V \leq 5.0$

(5) Timing Charts

1) Data receiving



2) Receiving INPUT PRIME

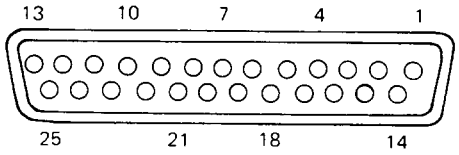


9.2 RS-232C Serial Interface

(1) Interface Connectors

Printer Side : Amphenol 17LE-13250 or equivalent
Cable Side : Amphenol 17JE-23250 or equivalent
Cable Length : 2 m (6.5 feet) max.

Shielded cable shall be used.



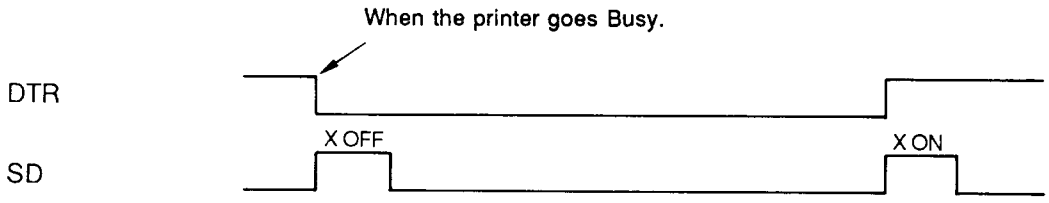
(2) Pin Assignment

Pin No.	Signal	IN/OUT Printer Controller	Pin No.	Signal	IN/OUT Printer Controller
1	FG		14	SCA	→
2	SD	→	15	NC	
3	RD	←	16	NC	
4	RTS (RS)	→	17	NC	
5	NC		18	NC	
6	DSR (DR)	←	19	NC	
7	SG		20	DTR	→
8	NC		21	NC	
9	NC		22	NC	
10	NC		23	NC	
11	SCA	→	24	NC	
12	NC		25	NC	
13	NC				

(3) Signal Description

Pin No.	Signal Name	IN/OUT	Explanation
1	FG	—	Frame Ground
2	SD	OUT	Send Data. Available if X-ON/OFF control mode is selected by the DIP switch on the serial interface board. This signal sends X-OFF (13H) when the printer goes Busy; X-ON (11H) when not Busy.
3	RD	IN	Receive Data. Receives data transmitted from the computer.
4	RTS	OUT	Request to Send. Always High (+11 V).
6	DSR	IN	Data Set Ready. If DSR is High (+11 V) or Open, the printer accepts data.
7	SG	—	Signal Ground on the interface.
11, 14	SCA	OUT	Secondary Request to Send. High (+11 V) if the printer is Busy.
20	DTR	OUT	Data Terminal Ready. Low (-11 V) if the printer is Busy.

(4) Timing Charts



(5) Standard Specifications

1) Baud rate

1200, 2400, 4800, 9600, and 19200 bauds

2) Synchronization

Start-stop

3) Communications protocol

Data Terminal Ready (DTR) or X-ON/X-OFF

4) Data format

9, 10 bits/character or 11 bits/character
7-bit or 8-bit serial:
1 Start bit, Data bits (7 or 8), Parity bit (0 or 1), 1 Stop bit

(6) Signal Level

Logic	Nominal output voltage	Receiving-end voltage
MARK (1)	-11 V	Less than -3 V
SPACE (0)	+11 V	More than +3 V

10. OPTIONAL EQUIPMENT

■ Cut Sheet Feeder (CSF): • 1-bin • 2-bin and envelope handling	Allows the printer to feed or eject cut forms (and envelopes) automatically.
■ Pull-up Tractor:	To be used for bottom feeding of continuous forms.
■ Ribbon Cassette: • 1" wide color ribbon • 1/2" wide black ribbon	For the models equipped with the ribbon shift mechanism.

CHAPTER II.
THEORY OF OPERATION

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1. PRINTER MECHANISMS

1.1 Print Mechanism

This printer uses wire dot-matrix impact printing. The print head is a releasing type, consisting of 18 permanent magnet circuits, 18 degaussing coils arranged on the circumference of a solid yoke, 18 armatures, 18 print wires, wire guides, and permanent magnet-charged leaf springs. The 18 print wires are arranged through the wire guides, particularly precision-arranged in two rows at the front end, so that they can work smoothly.

As the carrier holding the print head travels at the printing speed, the character generator sends print command pulses to the circuits driving the degaussing coils. Energizing a particular degaussing coil degausses the permanent magnet so that the corresponding magnetically compressed spring is released, forcing the print wire against the ink ribbon. The impact against the ribbon produces a dot on the paper. The print timing is determined by drive pulses from the rotary encoder mounted on the DC servomotor driving the carrier.

When the degaussing coil is deenergized, the spring is magnetically recompressed, whereby the print wire retracts to its original position.

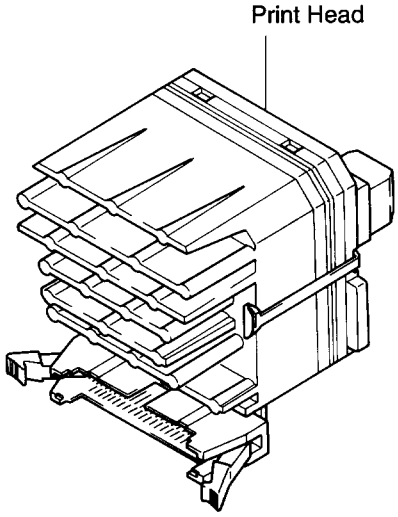


Figure 1.1 Print Head

1.2 Paper Feed Mechanism

The paper feed motor is a stepping motor which controls vertical motion. The rotation of the paper feed motor is transmitted to the platen gear via the motor gear, paper feed idle pulley, paper feed timing belt, and platen pulley.

If the continuous forms mode is selected, the paper feed idle gear 47 (clutch gear) engages the pin wheel drive gear (for the forms change mechanism, refer to Section 1.3) so that the motor rotation is further transmitted via the two paper feed idle gears 30 to the tractor drive gear.

For each step (1.8°) of clockwise rotation of the paper feed motor (as viewed from the left of the printer), the platen rotates counterclockwise and feeds the forms by 1/216 inch.

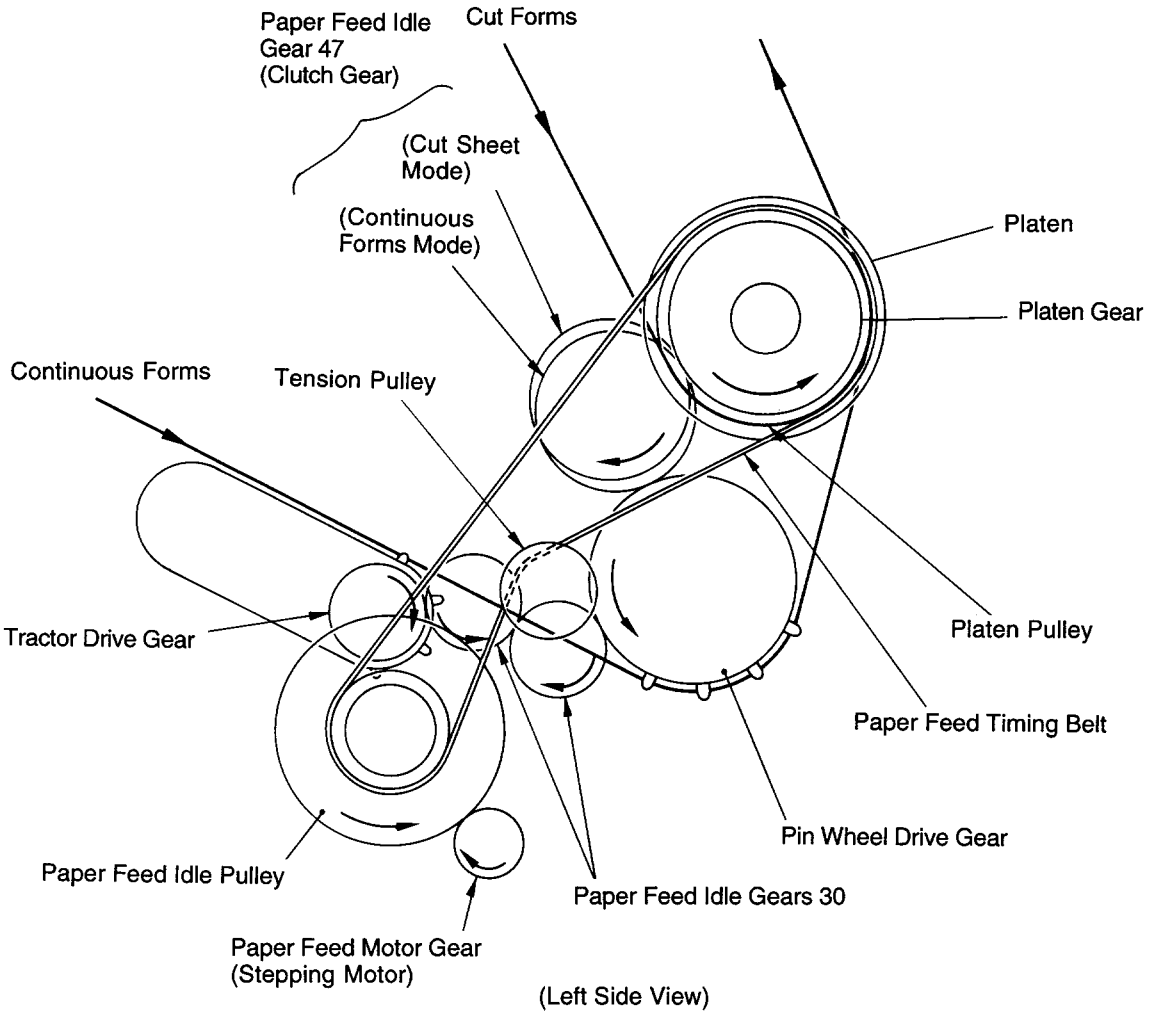


Figure 1.2 Paper Feed Mechanism

1.3 Forms Change Mechanism

Selecting the continuous forms or cut sheet mode from the switch panel automatically engages or disengages the paper feed idle gear 47 (clutch gear) with/from the pin wheel drive gear, respectively, as described in Section 1.2. What follows is a brief description of the forms change mechanism.

The rotation of the paper bail/forms change motor is transmitted via the paper bail/forms change idle gear and forms change gear to the forms change lever which shifts the clutch gear holder to engage or disengage the paper feed idle gear 47 (clutch gear) with/from the pin wheel drive gear. (See Figure 1.3.)

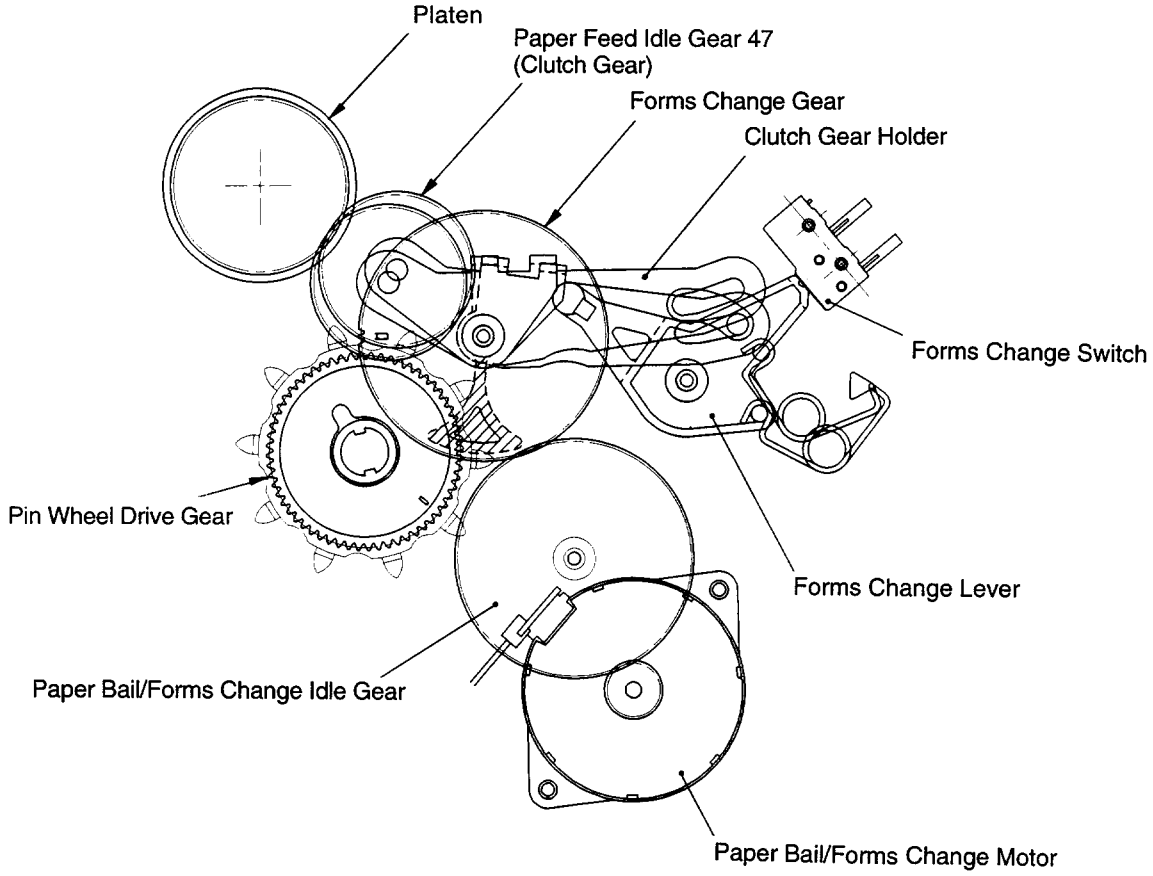


Figure 1.3 Forms Change Mechanism

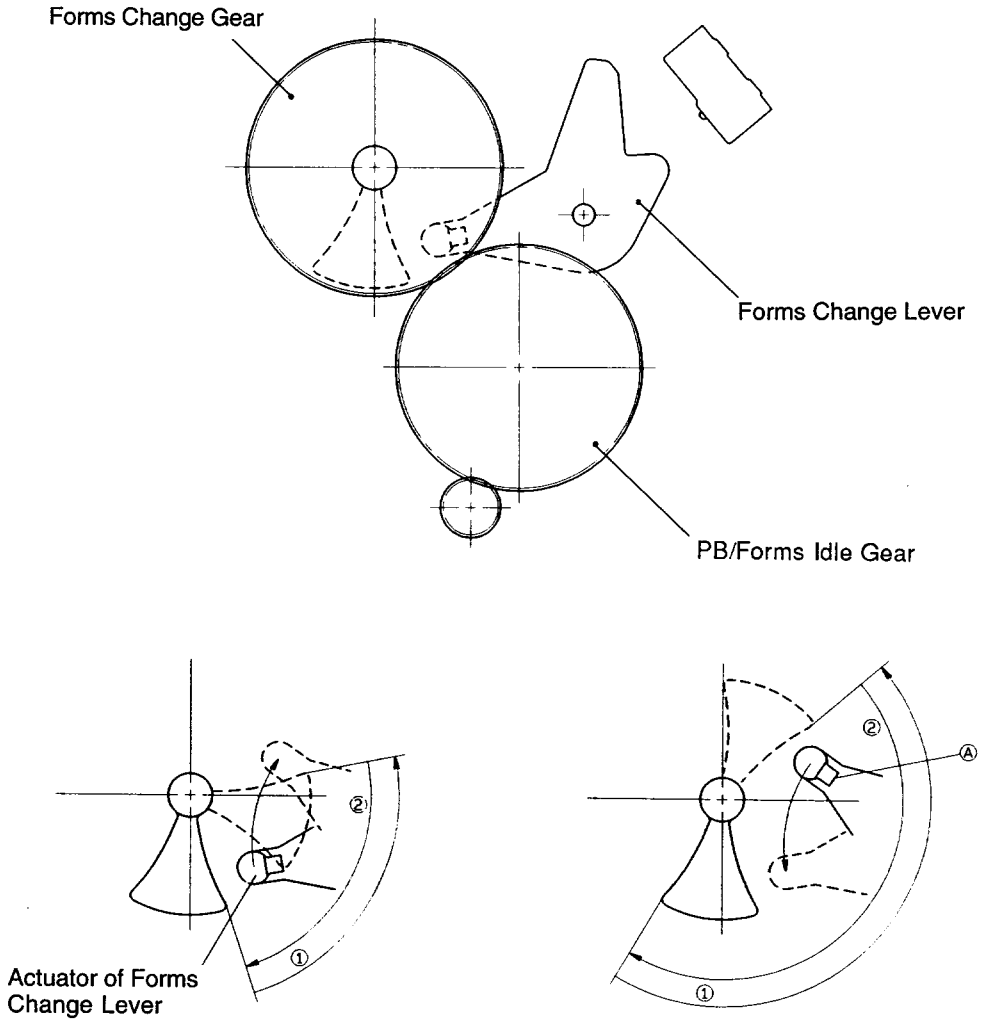
Figure 1.4 shows the operational relationship between the forms change gear and the forms change lever.

■ Switching from continuous forms to cut sheet mode

The forms change gear rotates counterclockwise until its cam makes the actuator of the forms change lever override the dead point from the continuous forms position to the cut sheet position. Next, the forms change gear rotates clockwise to return to the original position.

■ Switching from cut sheet to continuous forms mode

The forms change gear rotates counterclockwise until its cam overrides the actuator of the forms change lever. Next, the forms change gear rotates clockwise to return to the original position.



From continuous forms to cut sheet mode

From cut sheet to continuous forms mode

Figure 1.4 Forms Change Gear and Forms Change Lever

1.4 Carrier Drive Mechanism

The shuttle motion of the carrier holding the print head is controlled by the forward and reverse rotation of the carrier motor (DC servomotor).

Figure 1.5 shows the power transmission mechanism for the carrier drive. The rotation of the carrier motor is transmitted via the timing belt to the idle pulley and moves the carrier on the timing belt.

The CPU controls the carrier drive mechanism, based on the carrier position detected by the encoder mounted on the carrier motor.

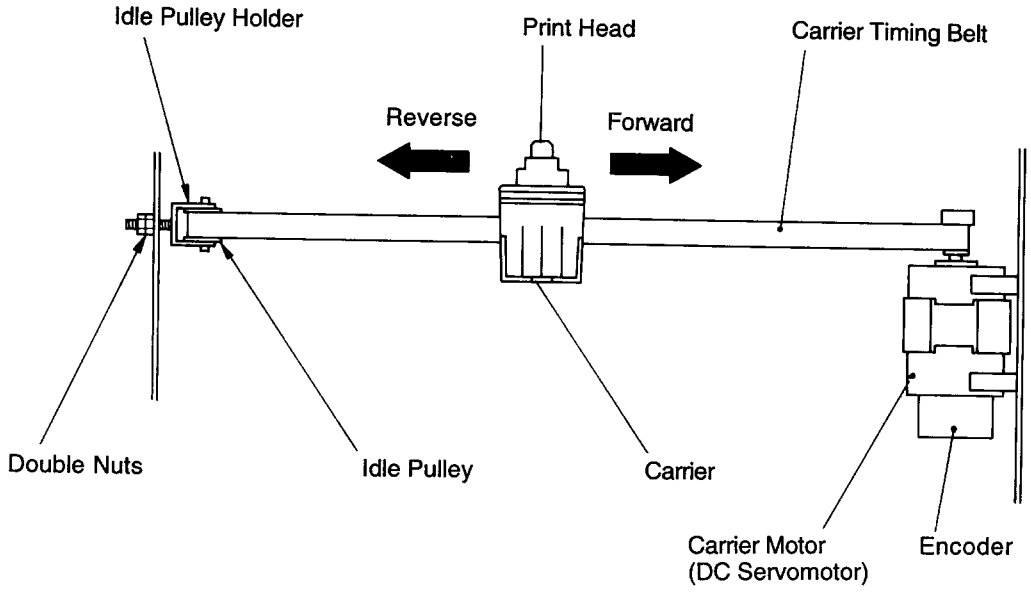


Figure 1.5 Carrier Drive Mechanism

1.5 Automatic Head-adjust Mechanism (Only for the models which apply)

The automatic head-adjust mechanism driven by the head-adjust motor (stepping motor) automatically adjusts the gap between the print head and the paper on the platen by rotating the eccentric main carrier rail along which the carrier travels.

The rotation of the head-adjust motor is transmitted via the head-adjust idle gear, head-adjust gears A, B, and C to the eccentric main carrier rail. Rotating the main carrier rail brings the carrier near the platen or away from it.

At the first step of the head-adjust operation, the head-adjust motor rotates to press the ribbon mask against the print paper loaded on the platen. To get the specified pressure against the print paper, the head-adjust gears A and B are joined with each other by means of the torque spring and those gears usually rotate together. When the force generated by the contact between the ribbon mask and the print paper becomes greater than the torque spring force, the head-adjust gear B stops its rotation. Since the gear B has the head-adjust slit ASSY, the encoder stops the signals which have been generated in synchronization with the stepping motor.

Upon recognition that there is no signal from the encoder, the controller stops the head-adjust motor after rotating it 6 pulses more to confirm the complete stop of the gear B.

At the second step, the controller rotates the head-adjust motor in the reverse direction by the specified number of pulses, thus providing the proper gap between the print head and paper.

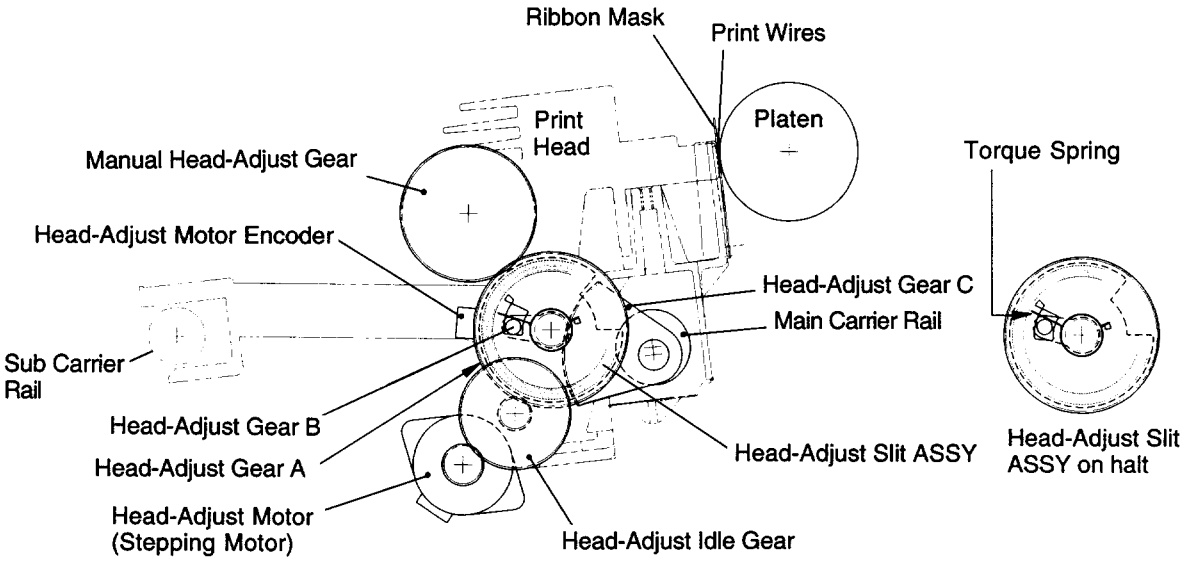


Figure 1.6 Automatic Head-adjust Mechanism

2. CONTROL ELECTRONICS

2.1 Overview

The control electronics consists of a main PCB, a switch panel PCB, an interface PCB, and a power supply unit.

The main PCB has three CPUs--the interface CPU (NEC μPD78C11), master CPU (μPD78213), and slave CPU (μPD78234), plus two gate arrays (μPD65032).

The interface CPU controls interface operations with the host computer, manages the printer input buffer, and transfers input data to the master CPU. The master CPU manages various operations of the interface CPU, slave CPU, gate arrays, switch panel, ROMs, and RAMs. The slave CPU controls the motors, monitors the status of the sensors, and generates the timing signals for printing operation under control of the master CPU.

The two same gate arrays control the head driver and work as decoders/encoders for the interface CPU and master CPU.

2.2 Block Diagram of the Control Electronics

Figure 2.1 shows a block diagram of the printer control electronics.

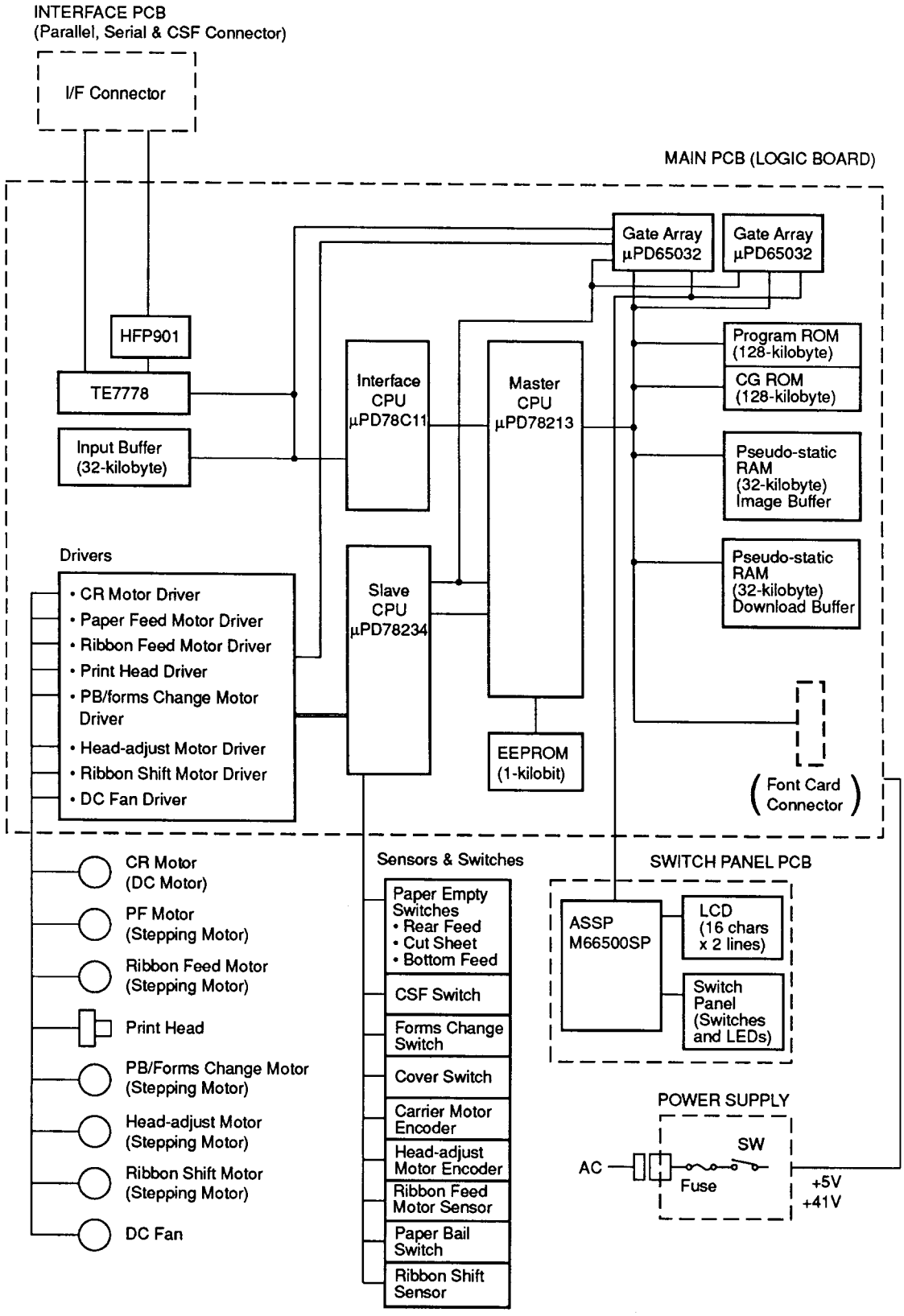


Figure 2.1 Block Diagram of Printer Electronics

2.3 Main PCB

2.3.1 Interface CPU and its related circuitry

The interface CPU is an NEC μPD78C11 integrating a 4-kilobyte mask ROM. The CPU controls an LSI TE7778 called a combination peripheral controller to exchange data with the host computer through the parallel or serial interface.

Figure 2.2 shows the data flow on the parallel and serial interfaces.

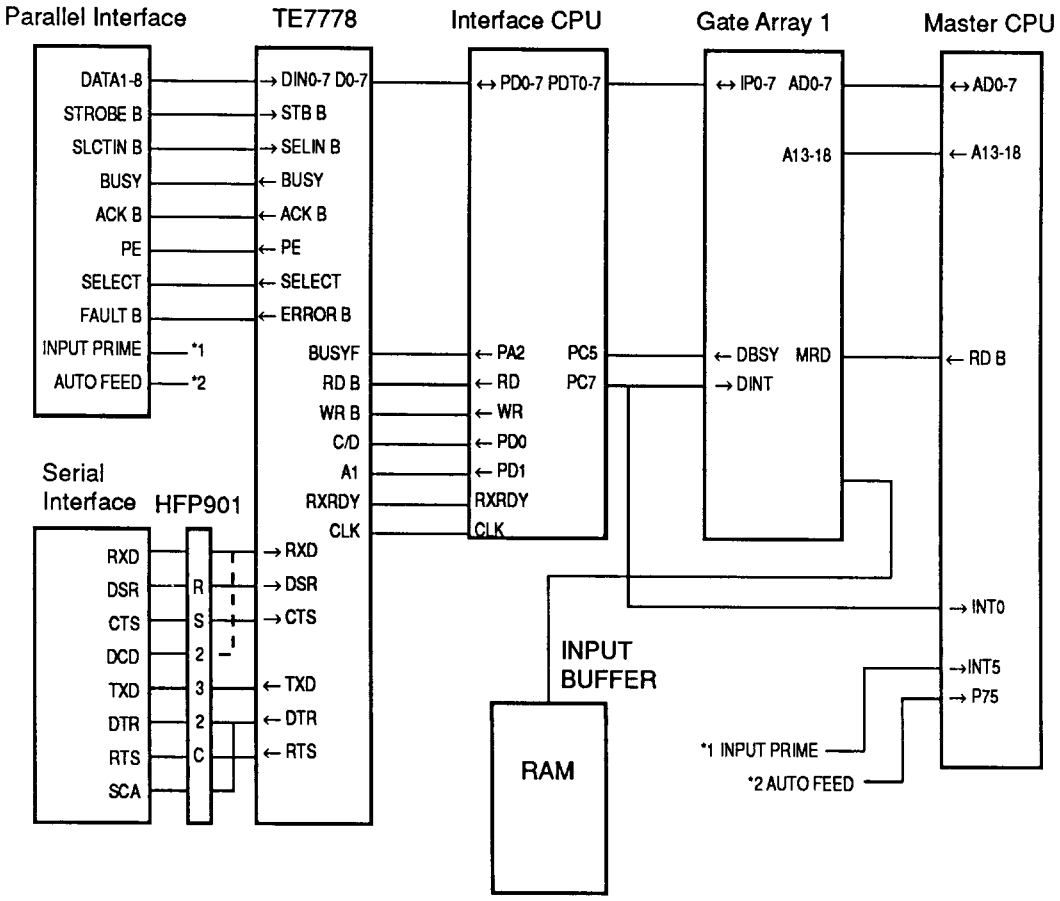


Figure 2.2 Interface Data Flow

(1) Parallel Interface

The interface CPU controls TE7778 to receive data from the parallel interface, stores the data into the input buffer through the gate array temporarily, and transfers them to the master CPU.

(2) Serial Interface

The interface CPU conveys serial data inputted from the serial interface HFP901 (RS-232C interface module) to TE7778 which converts the data to the parallel data. The subsequent data flow is the same as that of the parallel interface operations.

(3) Combination peripheral controller TE7778

The LSI TE7778, which is packed in 48-pin QFP, supports both serial and parallel interface operations.

The TE7778 converts parallel data sent from the interface CPU into the serial data and transfers them to an external device through the TxD pin of the serial interface. It also converts serial data sent from the RxD pin of the serial interface into the parallel data which the interface CPU can receive.

For the parallel interface operations, the TE7778 conforms to the Centronics parallel interface equipped with the additional handshaking pin feature. Upon receipt of data with a DATA STROBE signal from the external device, the TE7778 automatically returns a BUSY signal to the parallel interface to tell the interface CPU its busy status through the BUSYF pin.

■ Pin Assignment

What follows is a functional pin assignment of TE7778.

Pin No.	Signals	Functions
1	$\overline{DSR}$	Input signal for Data Set Ready of modem
2	$\overline{WR}$	Input signal of Write Enable pulse for data output through the data bus
3	$\overline{RD}$	Input signal of Read Enable pulse for data or status input through the data bus
4	RxRDY	Output signal telling the CPU that receive data is ready to be read on its data bus after completion of serial-to-parallel conversion If parallel data is present, this signal turns High; if the data has been read, this signal turns Low.
5	TxRDY	Output signal telling CPU to write data
6	Vss	Signal ground
7	$\overline{ACK}$	Output signal of Acknowledge to host computer
8	BUSY	Output signal of Busy to host computer
9-16	DIN0-DIN7	Input of 8-bit parallel data from host computer
17	PE	Output signal of Paper Empty to host computer
18	Vss	Signal ground
19	VDD	+5V power input
20	SELECT	Output signal of Select to host computer
21	$\overline{ERROR}$	Output signal of Error ($\overline{FAULT}$) to host computer
22	INPRME	Input signal of Input Prime from host computer (Not used for this printer.)

Pin No.	Signals	Functions
23	$\overline{\text{SELIN}}$	Input signal of Select In from host computer
24	BSYF	Output signal of Data Ready Flag to interface CPU
25	$\overline{\text{STB}}$	Input of Data Strobe pulse from host computer
26	$\overline{\text{CS}}$	Input signal of Chip Select for TE7778
27	CLK	Clock input for the serial data transfer rating
28	A1	Input signal to choose the data mode--serial or parallel Low for serial; High for parallel.
29	A0	Input signal identifying data on the data bus as send/receive data or command/status information Low for send/receive data; High for command/ status information.
30	RESET	Reset pulse input signal to initialize TE7778 High for reset.
31	Vss	Signal ground
32-35 38-41	D0-D7	8-bit, 3-state bidirectional data bus
36, 37		Not used.
42	Vss	Signal ground
43	VDD	+5V power input
44	TxD	Serial send data output
45	$\overline{\text{DTR}}$	Output signal of Data Terminal Ready for modem
46	$\overline{\text{RTS}}$	Output signal of Request to Send for modem (Not used for this printer.)
47	RxD	Serial receive data input
48	$\overline{\text{CTS}}$	Input signal of Clear to Send (Not used for this printer.)

(4) Interface CPU, μPD78C11AGF

The interface CPU, which is packed in 64-pin QFP, integrates a 4-kilobyte ROM and operates at 14.74 MHz.

■ Memory Map of Interface CPU

Memory Address	Space	Applications
0000H-0FFFH	4 kilobytes	Program storage
4000H-BFFFH	32 kilobytes	Input buffer for banks 0-3, expandable to the maximum of 128 kilobytes
C000H-FF00H		Chip Select for LSI TE7778

The interface CPU transfers data received from the host computer to the master CPU through TE7778. If the master CPU is busy, the interface CPU stores the data into the input buffer temporarily. The interface CPU also outputs status signal sent from the master CPU to the host computer through TE7778.

■ Pin Assignment

What follows is a functional pin assignment of the interface CPU μPD78C11

Pin No.	Signals	Functions
1	MTIFLT	Input signal of Fault from the master CPU
2	MTIPE	Input signal of Paper Empty from the master CPU
3-10	PDT0-PDT7	Output bus to the master CPU for data sent from host computer or the input buffer
11	IMTxD	Output line to the master CPU for serial data transmission
12	IMRxD	Input line from the master CPU for serial data transmission
13	IMSCK	Clock output for serial data transmission with the master CPU Rated at 9,600 baud
14	CRDLY	Not used.
15	GACLK	Basic clock output for the gate arrays Rated at 2.4567 MHz
16	DBSY	Data busy signal input from the master CPU

Pin No.	Signals	Functions
17	SICLK	Clock output for serial interface baud rate
18	DINT	Interrupt signal output for data transmission to the master CPU
19	(NMI)	Non-maskable Interrupt signal, pulled-up at +5V always
20	IFPRIME	Initialization signal input to the interface CPU from the master CPU
21	(MODE1)	Operation mode select signal of the CPU, pulled-up at +5V always
22	RESET	Hardware reset signal
23	(MODE0)	Operation mode select signal of the CPU, always at 0V
24, 25	X2, X1	Termination pins for the oscillator element of the CPU system clock
26	Vss	Signal ground
27	AVss	Signal ground for A/D converter
28, 31-35		Not used.
29	—	Input of the input buffer size
30	—	Input of the serial interface specifications
36, 37	+5V	+5V power input
38	IRD	RD signal of the interface CPU
39	IWR	WR signal of the interface CPU
40	IALE	ALE signal of the interface CPU
41-48	IA8-IA15	Upper address bus of the interface CPU
49-56	IAD0-IAD7	Lower address bus and data bus of the interface CPU
57	(STOP)	Not used.
58	Vdd	+5V power input
59, 60	IFRMB0-1	RAM bank select signal for the input buffer
61	BSYF	Input signal from TE7778, telling that input data is ready to be sent. (For parallel interface operation)
62	RxRDY	Input signal from TE7778, telling that input data is ready to be sent. (For serial interface operation)
63	CPUBUSY	Busy signal input from the master CPU
64	MTISLT	Select signal input from the master CPU

(5) Data transfer from the interface CPU to the master CPU

The data transfer from the interface CPU to the master CPU follows the sequences below:

1) The interface CPU monitors DBSY signal on pin 92 of the gate array 2 (#16). If the DBSY signal is Low, it sets data to be transferred onto the data bus PDT0-PDT7 (pins 3-10 of the Port B).

2) The interface CPU issues an interrupt signal DINT (pin 18) to the master CPU and the gate array 2.

3) Upon receipt of the DINT signal, the gate array 2 turns the DBSY signal High and outputs data on the bus PDT0-PDT7 onto the bus D0-D7. The data on D0-D7 is read by the master CPU through the data bus AD0-AD7 with the gate array 1.

4) Upon completion of the reading operation, the master CPU issues an RD signal to turn the DBSY signal Low so that the master CPU becomes ready to read the next data.

■ Block Diagram and Timing Scheme

Figures 2.3 and 2.4 show a block diagram of the above data transfer paths and its basic timing scheme, respectively.

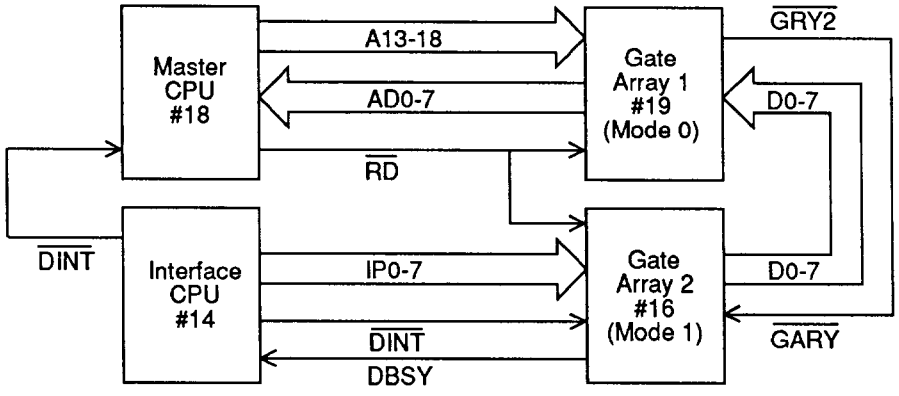


Figure 2.3 Data Transfer from Interface CPU to Master CPU

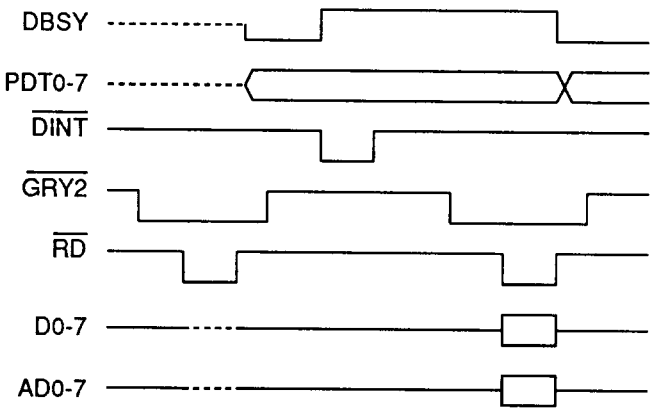


Figure 2.4 Basic Timing of Data Transfer

2.3.2 Master CPU and its related circuitry

The master CPU is an NEC μPD78213 operating at 12 MHz. It is used in the 1-megabyte extended mode in which the program ROM area occupies 64 kilobytes and the data memory area occupies the remainder.

The master CPU controls data input through the interface CPU, and controls the motors as well as monitoring the sensors through the slave CPU. It also controls the switch panel through LSI M66500SP and the print format memory (EEPROM).

(1) Block diagram and memory map

Figure 2.5 shows a block diagram of the master CPU and its related circuitry; Figure 2.6 shows the memory map of the master CPU.

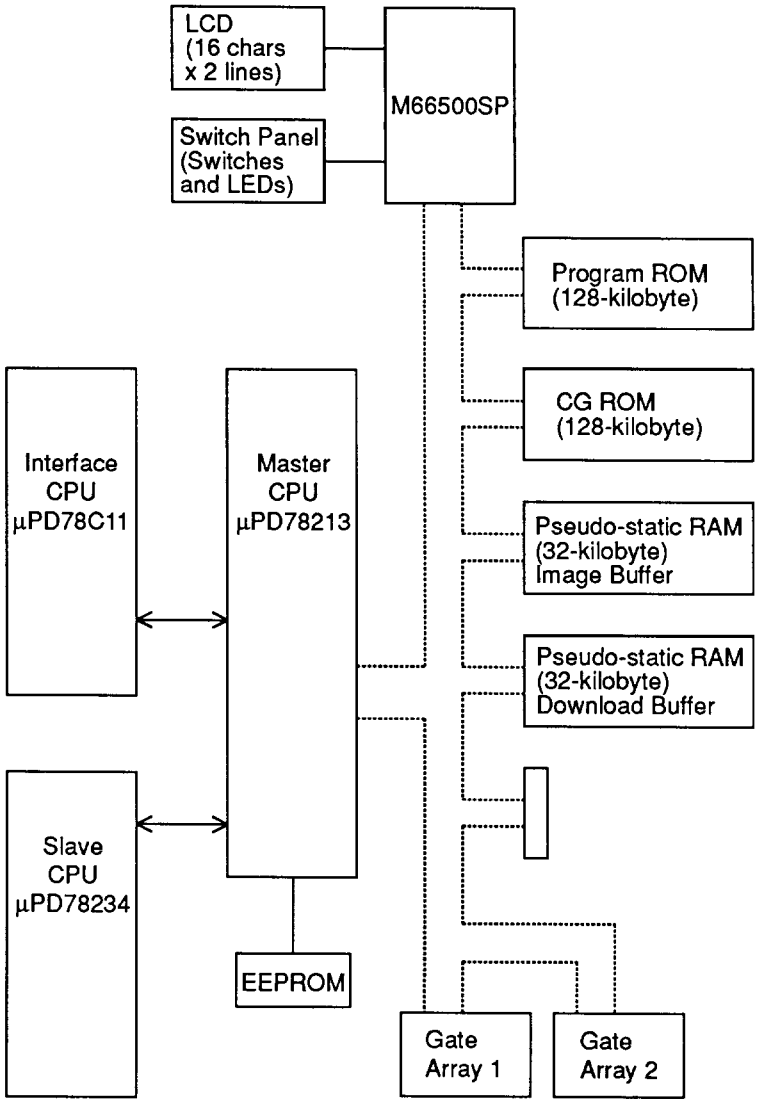


Figure 2.5 Block Diagram of Master CPU

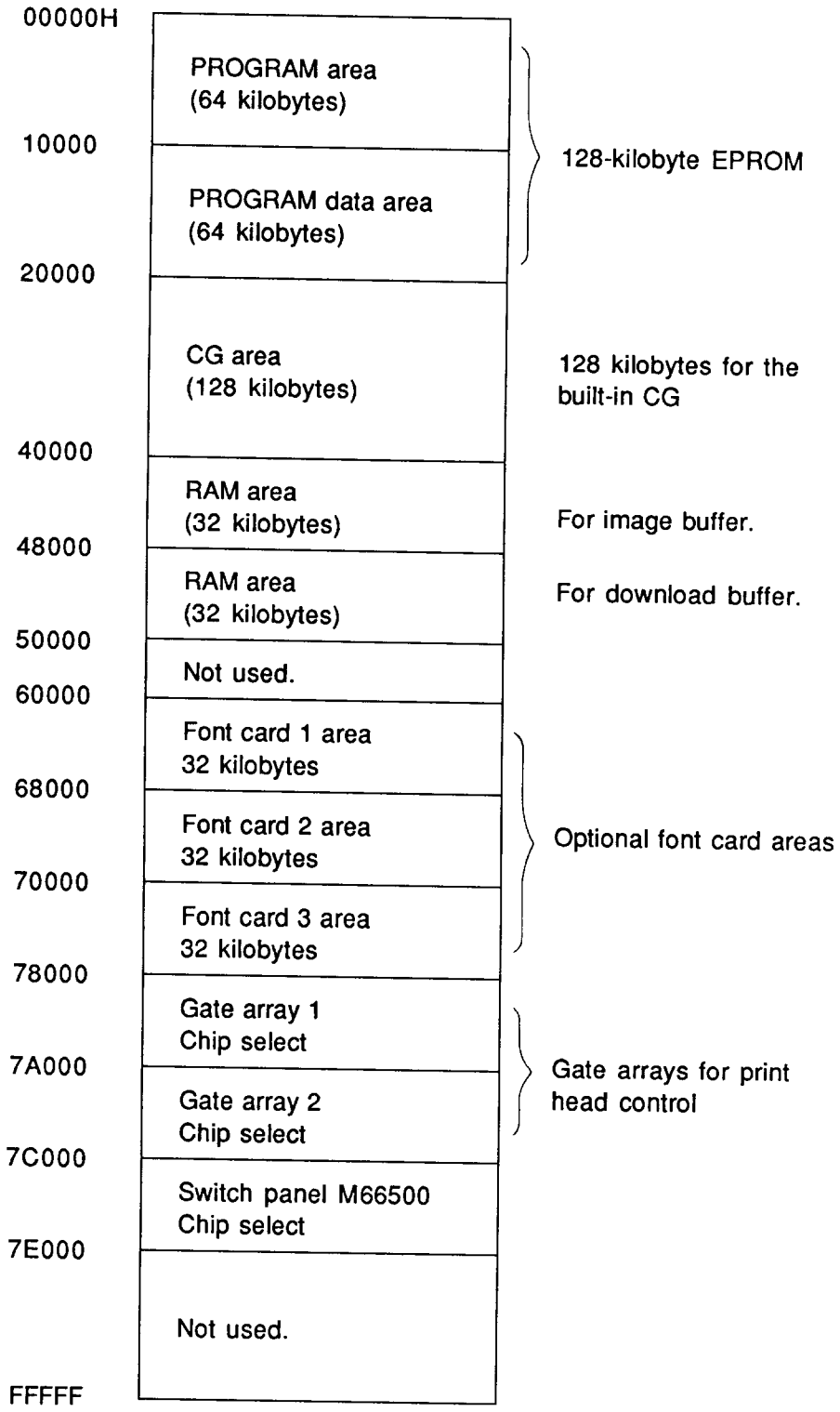


Figure 2.6 Memory Map of Master CPU

(2) Pin assignment

What follows is a functional pin assignment of the master CPU.

Pin No.	Signals	Functions
1	RD	Read signal output
2	(A19)	Not used.
3-5	A18-A16	Extended address bus
6	RESET	CPU hardware reset signal input
7, 8	X2, X1	Termination pins for the oscillator element of the system clock
9	±0V	Signal ground
10-17	A15-A8	Address bus
18-23	AD7-AD2	Address/data bus
24	±0V	Signal ground
25, 26	AD1, AD0	Address/data bus
27	ASTB	ALE signal
28	(NMI)	Pulled-up at +5V always
29	DINT	Data interrupt signal input from the interface CPU
30	SINT	Serial data transfer request signal input from the slave CPU
31	FRINT	Interrupt signal input from the slave CPU, allowing the master CPU to check the print direction
32	PRCLK	Interrupt signal input from the slave CPU, posting the print timing
33	IMSCK	Timing clock input for serial data transfer with the slave CPU
34	INPRIME	Input signal of INPUT PRIME from host computer
35	BUFBUSY	Toggle signal input, telling that the communications data buffer in the slave CPU is free
36	IMTxD	Serial data input from the interface CPU
37	IMRxD	Serial data output to the interface CPU
38	MSSCK	Clock signal output for serial data transfer with the slave CPU
39	SB0	Bidirectional data transfer line with the slave CPU
40	(EA)	Operation mode switching signal input Always at ±0V in this printer to operate in the external access mode

Pin No.	Signals	Functions
41	+5V	Power input
42	±0V	Signal ground for A/D converter
43	+5V	Reference voltage input for A/D converter Always at +5V for no A/D converter application
44	ATFEED	Auto FEED signal input from host computer in parallel interface operation
45	(CRDLY)	Not used.
46	SLVACT	Input signal, indicating that the slave CPU is in operation High for "in operation"
47	FLG	Input signal from the slave CPU, posting the printing direction High for the forward direction
48	ORC	Input signal of EEPROM status
49	DO	Data input line from EEPROM
50	CPUBUSY	Output signal to tell the interface CPU that the master CPU is busy
51	MTISLT	Output signal of SLCT to the interface CPU
52	MTIFLT	Output signal of FAULT to the interface CPU
53	MTIPE	Output signal of PE to the interface CPU
54	DI	Data transfer line to EEPROM
55	CLK	Clock output to EEPROM
56	CS	Chip select signal output to EEPROM
57, 58	P03, P04	Not used.
59	MRDY	Output signal, posting the data send/receive mode with the slave CPU High for send mode of the master CPU
60	PRPRIME	Output signal to command the slave CPU to cut off the drive power to all motors when the +41V source falls by 10V or more
61	IFPRIME	Initialization signal output to the interface CPU
62	(AN7)	Checks the voltage level of +41V source
63	MCUTFF	Output signal to cut off all output of the power supply unit
64	WR	Write signal output

2.3.3 Slave CPU and its related circuitry

The slave CPU is an NEC μPD78234 integrating a 16-kilobyte mask ROM, which operates at 12 MHz. It is packed in 80-pin QFP and has no external memory access.

The slave CPU controls the motors--carrier motor, paper feed motor, paper bail/forms change motor, ribbon feed motor, ribbon shift motor, and head-adjust motor. It also controls the print timing pulse output and monitors the sensors and errors.

(1) Block diagram

Figure 2.7 shows a block diagram of the slave CPU and its related circuitry.

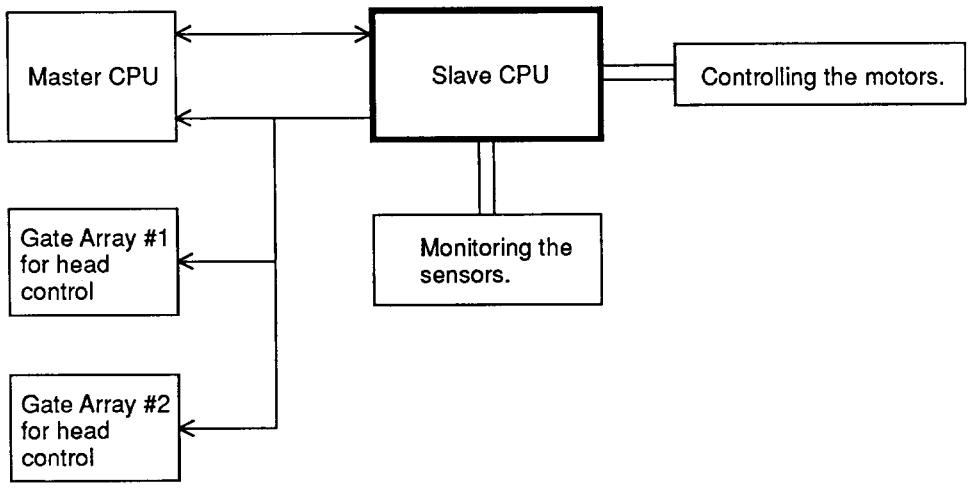


Figure 2.7 Block Diagram of Slave CPU

(2) Pin assignment

What follows is a functional pin assignment of the slave CPU.

Pin No.	Signals	Functions
1	MSSCK	Clock input for data transfer with the master CPU
2	SB0	Data transfer line with the master CPU
3	FLG	Output signal to tell the printing direction High for the forward direction
4	FRINT	Interrupt signal output, posting the establishment of FLG signal
5	SINT	Interrupt signal output for data send request to the master CPU

Pin No.	Signals	Functions
6	RBMCLK	Clock signal output to control the ribbon feed motor
7	RESET	Hardware reset signal input
8	+5V	+5V power input
9, 10	X2, X1	Termination pins for the oscillator element of the system clock
11	±0V	Power ground
12	PRCLK	Print timing pulse output
13	(P01)	Not used.
14	P5VON	Output signal to control the P5V power source
15	SCUTFF	Output signal to cutoff the power supply output
16-19	LFM1-LFM4	Phase excitation signals for the paper feed motor
20	AC	Identification signal input of Auto Cut Sheet Feeder
21	CF	
22		Not used.
23	RIBNS	Status input of the cassette ribbon width sensor Low for 1" width ribbon; High for 1/2" ribbon
24-27	CCM4-CCM1	Phase excitation signals for the ribbon shift motor
28	CCMSEL	Drive signal output for the ribbon shift motor
29	LFMSEL	Drive signal output for the paper feed motor
30	HDERR	Error input of the print head driver
31	PRSSEL	Drive signal output for the head-adjust motor
32-35	PRSM4-PRSM1	Phase excitation signal outputs for the head-adjust motor
36	VIACK	Output signal indicating the end of the interrupt processing for EINT
37	(P46)	Not used.
38	RBMSEL	Drive signal output for the ribbon feed motor
39	PBLSEL	Drive signal output for the paper bail/forms change motor
40-43	PBLM4-PBLM1	Phase excitation signal outputs for the paper bail/forms change motor
44	(ASTB)	Not used.

Pin No.	Signals	Functions
45	±0V	Power ground
46	(MODE)	±0V
47	FANCNT	Speed control signal output for the cooling fan motor (DC motor)
48	CRMCO	Speed control signal output for the carrier motor
49	FWD	Forward drive signal output for the carrier motor
50	REV	Reverse drive signal output for the carrier motor
51	BOPINI	Input signal of the paper bail switch sensing its initial position
52	CUSHL	Form change switch signal input Low for cut sheet, ACF, and bottom feed modes; High for rear feed mode
53	CVERS	Input signal of the cover switch status Low for the cover closed; High for the cover open
54	RENPE	PE signal input for continuous forms (rear feed) Low for paper present; High for paper empty
55	+5V	+5V power input
56	TANPE	PE signal input for cut sheets Low for paper empty; High (1.8V or more) for paper present
57	BTMPE	PE signal input for continuous forms in the bottom feeder Low for paper empty; High (1.8V or more) for paper present
58	ETLALM	Error check signal input from the drivers of the paper feed, paper bail/forms change, ribbon shift, and head-adjust motors
59	RBMALM	Error check signal input from the ribbon feed motor driver
60	FANERR	Error check signal input from the fan motor
61, 62		Not used.
63	SFTINT	Input signal from the ribbon shift sensor sensing the initial position of the ribbon shift motor
64	+5V	Power input for the A/D converter
65	+5V	Reference voltage input for the A/D converter
66	±0V	Signal ground for the A/D converter

Pin No.	Signals	Functions
67	ANO0	Output of the reference limit value for the carrier motor drive current
68		Not used.
69	±5V	Reference voltage input for the D/A converter
70	±0V	Ground for the reference voltage input for the D/A converter
71	PRPRIME	Initialization signal output of the slave CPU
72	EINT	Interrupt signal input from the carrier motor encoder
73	MBRK	Error check signal input from the carrier motor driver or paper feed motor driver
74	SLV23	Interrupt signal input from the encoder slit (head-adjust) sensor
75	ENCO1	Input signal from the carrier motor encoder
76	SLV25	Interrupt signal input from the encoder slit (head-adjust) sensor
77	DIRFR	Input signal telling the travel direction of the carrier
78	MRDY	Input signal posting the data send/receive mode of the master CPU High for send mode; Low for receive mode
79	BUFBSY	Toggle signal output, indicating whether the CPU is ready to receive a command from the master CPU Low for ready state; High for not-ready state
80	SLVACT	Output signal, indicating whether the slave CPU is in execution of the given command High for under execution

(3) Motor control

1) Carrier Motor

- Controlling the carrier travel direction (carrier motor revolution direction):

The slave CPU turns its output FWD (pin 49) or REV (pin 50) Low to move the carrier in the forward or reverse direction, respectively*.

* To recognize the carrier travel direction, the slave CPU monitors the signal level of DIRFR (pin 77) every interruption of EINT signal (pin 72).

- Controlling the carrier travel speed (carrier motor speed):

The slave CPU monitors the frequency of ENCO1 signal (pin 75) and regulates the carrier motor drive current by controlling CRMCO signal (pin 48) to chop the current. The software of the slave CPU controls the ON/OFF duty of the CRMCO signal every approx. 50 μs.

The analog output level of CRREF signal (pin 67) limits the maximum current applied to the carrier motor.

Figures 2.8 and 2.9 show the timing schemes to drive the carrier motor in the forward and reverse direction, respectively.

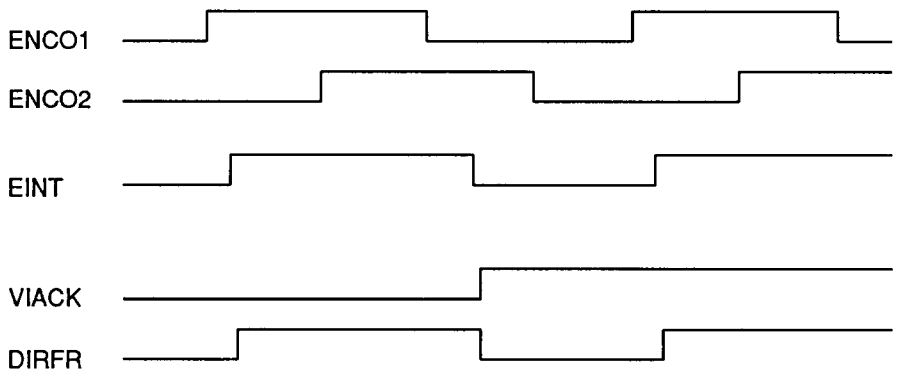


Figure 2.8 Timing Scheme for Forward Drive

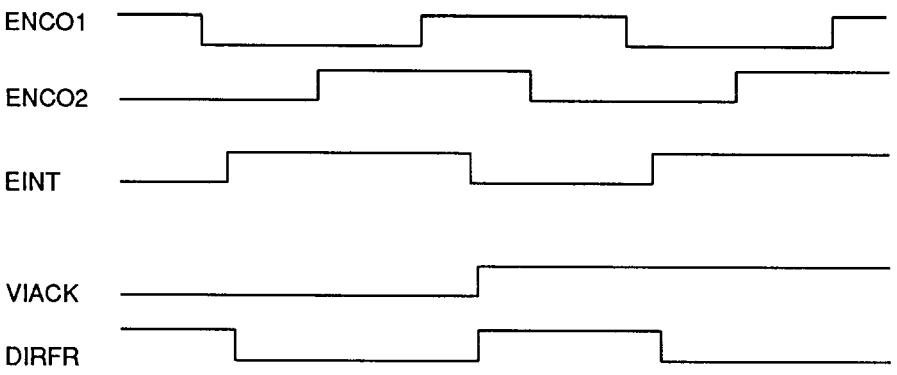


Figure 2.9 Timing Scheme for Reverse Drive

2) Paper Feed Motor

To excite the phase of the paper feed motor (stepping motor) driven by the 2-2 phase excitation with unipolar constant current, the slave CPU first turns $\overline{\text{LFMSEL}}$ signal (pin 29) Low and then turns signals $\overline{\text{LFM1}}$-$\overline{\text{LFM4}}$ Low sequentially according to the timing scheme as shown in Figure 2.10.

While the paper feed motor is idle, the paper feed driver applies a certain hold current to the motor in order to give it a static torque which is necessary for keeping the motor mechanism stable.

The slave CPU excites the motor phase in the sequence of $\overline{\text{LFM1}} \rightarrow \overline{\text{LFM2}} \rightarrow \overline{\text{LFM3}} \rightarrow \overline{\text{LFM4}} \rightarrow \overline{\text{LFM1}} \rightarrow$ ... for the forward paper feed; in reverse sequence for the reverse feed, with the timing shown in Figure 2.10.

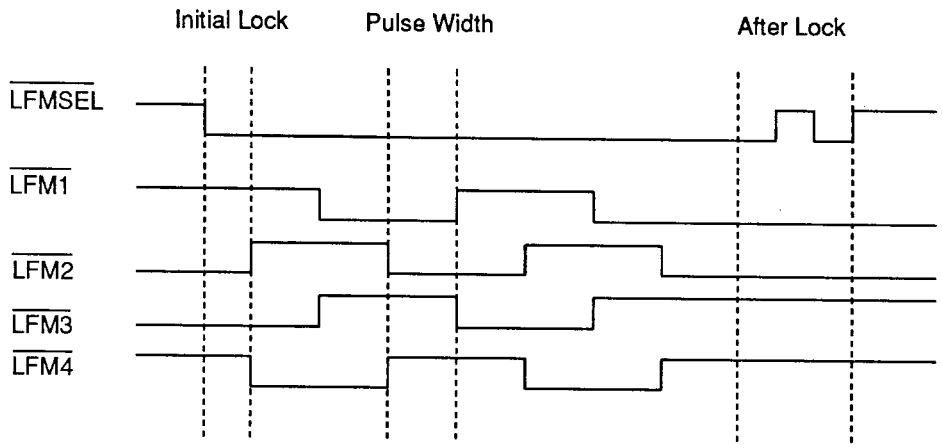


Figure 2.10 Timing Scheme for Paper Feed Motor Drive

3) Paper Bail/Forms Change Motor

A single stepping motor drives both the paper bail mechanism and the forms mode switching (between the cut sheet and continuous form modes) mechanism. The slave CPU controls this 2-2 phase stepping motor depending upon the current bail position relative to the reference position, as shown in Figure 2.11.

The slave CPU excites the motor phase in the sequence of $\overline{\text{PBLM1}} \rightarrow \overline{\text{PBLM2}} \rightarrow \overline{\text{PBLM3}} \rightarrow \overline{\text{PBLM4}} \rightarrow \overline{\text{PBLM1}} \rightarrow$ ... to open the paper bail; in the reverse sequence to close it, with the timing shown in Figure 2.12.

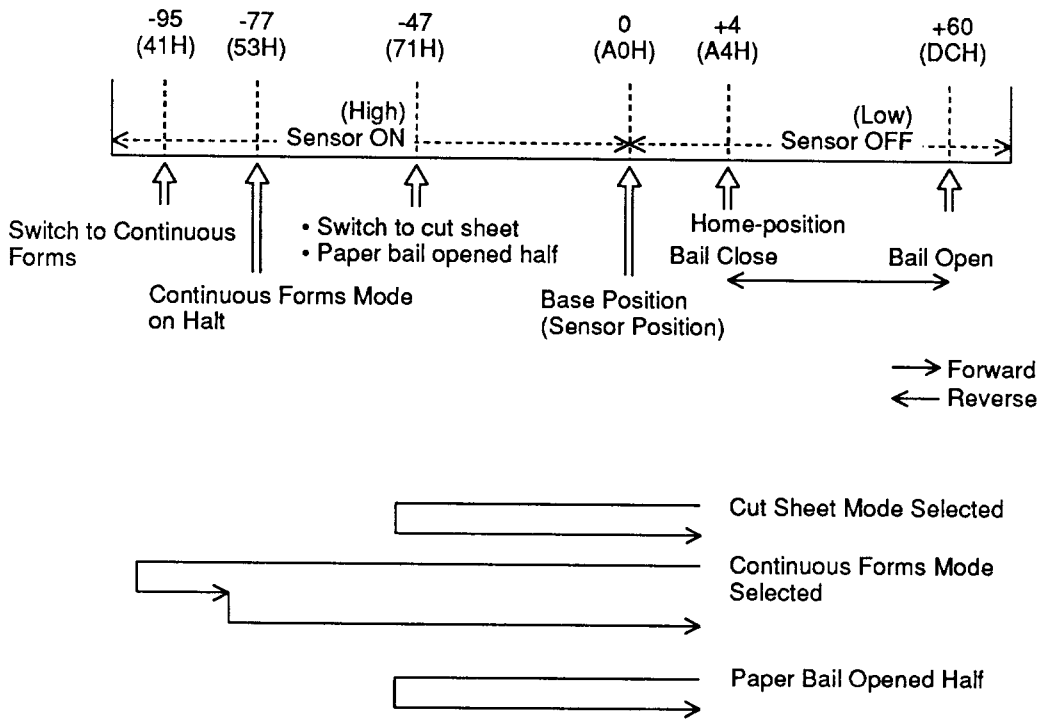


Figure 2.11 Paper Bail Movement

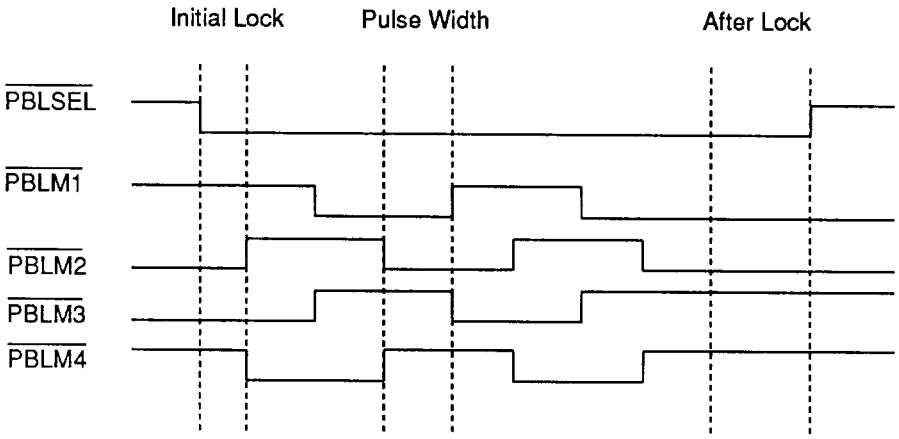


Figure 2.12 Timing Scheme for Paper Bail/Forms Change Motor Drive

4) Ribbon Feed Motor

To drive the ribbon feed motor, the slave CPU issues a phase excitation clock pulse RBMCLK (pin 6) and ribbon motor select signal $\overline{\text{RBMSEL}}$ (pin 38).

The gate array generates 2-2 phase excitation pulses.

The slave CPU controls the issuing rate of RBMCLK at 175 pps for the forward ribbon feeding and at 400 pps for the reverse feeding.

Figure 2.13 shows the timing scheme to control the ribbon feed motor.

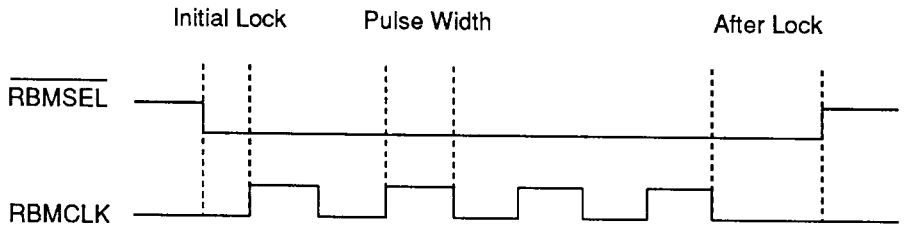


Figure 2.13 Timing Scheme for Ribbon Feed Motor Drive

5) Ribbon Shift Motor

The slave CPU drives this motor to shift ribbon or change color when the 1" black or 1" color ribbon is used. It drives the motor based on the reference position as shown in Figure 2.14

The slave CPU issues 2-2 phase excitation pulses in the sequence of $\overline{\text{CCM1}} \rightarrow \overline{\text{CCM2}} \rightarrow \overline{\text{CCM3}} \rightarrow \overline{\text{CCM4}} \rightarrow \overline{\text{CCM1}} \rightarrow$ ... to shift up the ribbon; in the reverse sequence to return it down, with the timing scheme shown in Figure 2.15.

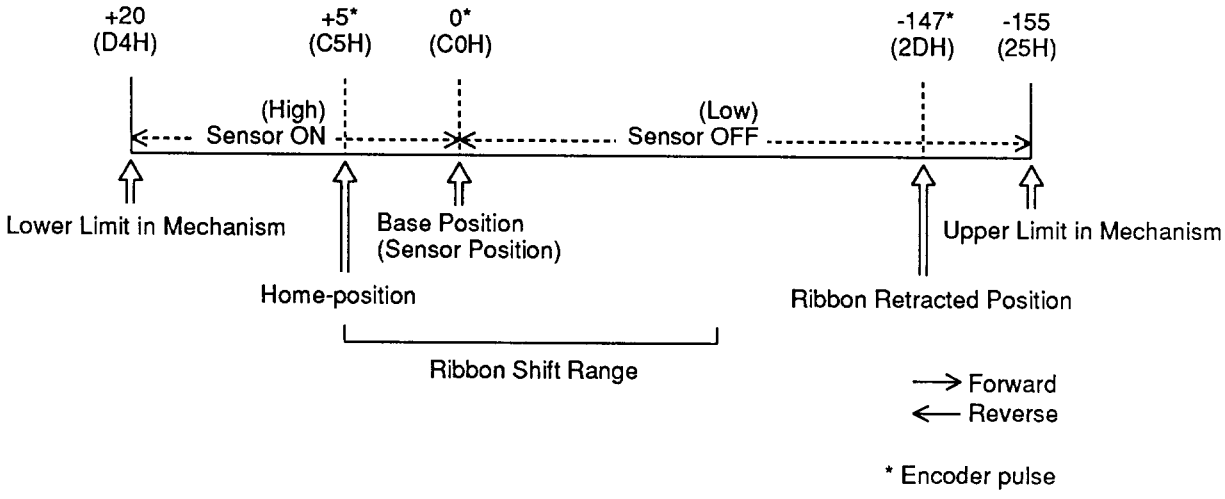


Figure 2.14 Ribbon Shift Range and Positioning

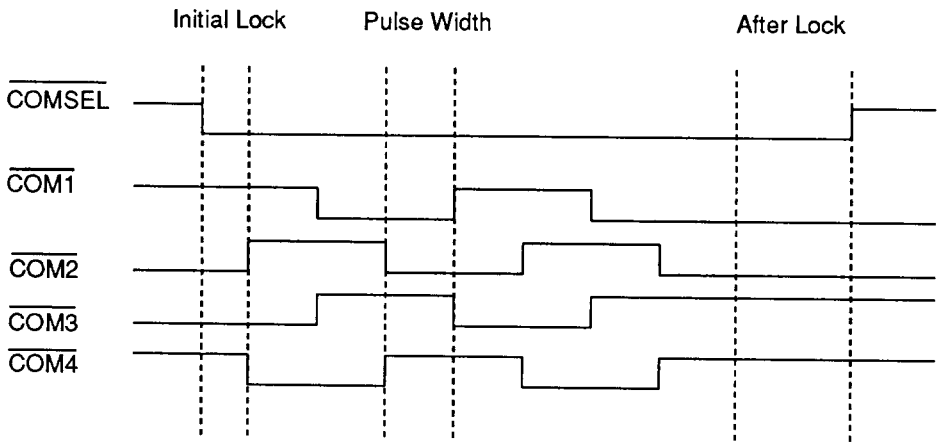


Figure 2.15 Timing Scheme for Ribbon Shift Motor Drive

6) Head-adjust Motor

The slave CPU drives the head-adjust motor to keep the gap between the print head and paper on the platen constant. It monitors output signals of the encoder rotating with this motor for controlling the drive pulse to determine the motor rotation.

The motor is a 2-2 phase excited stepping motor whose exciting pulse sequence is $\overline{PRSM1} \rightarrow \overline{PRSM2} \rightarrow \overline{PRSM3} \rightarrow \overline{PRSM4} \rightarrow \overline{PRSM1} \rightarrow$ ... to move the print head towards the paper; in the reverse sequence to release it, with the timing scheme shown in Figure 2.16.

Figure 2.17 shows the encoder output pulse sequence for moving the print head towards the paper.

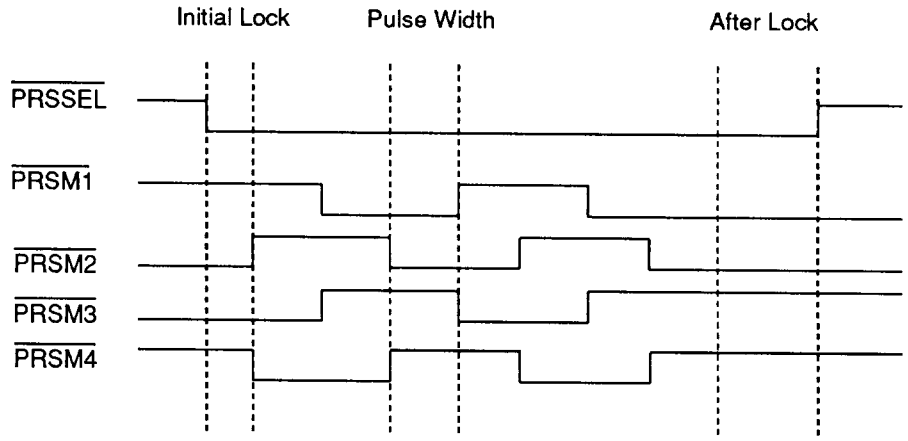


Figure 2.16 Timing Scheme for Head-adjust Motor Drive

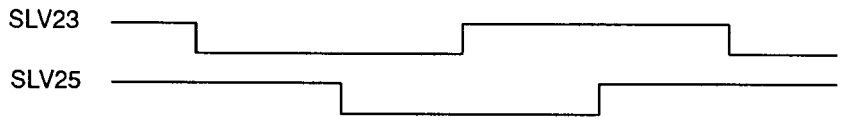


Figure 2.17 Encoder Output Pulses

(4) Issuing the print timing pulses

Upon receipt of print range information from the master CPU, the slave CPU issues print timing pulse PRCLK (pin 12) for every print column as shown by interrupt signal EINT (pin 72), from the print starting position to the ending position.

Figure 2.18 shows the print timing pulse issue to the print area.

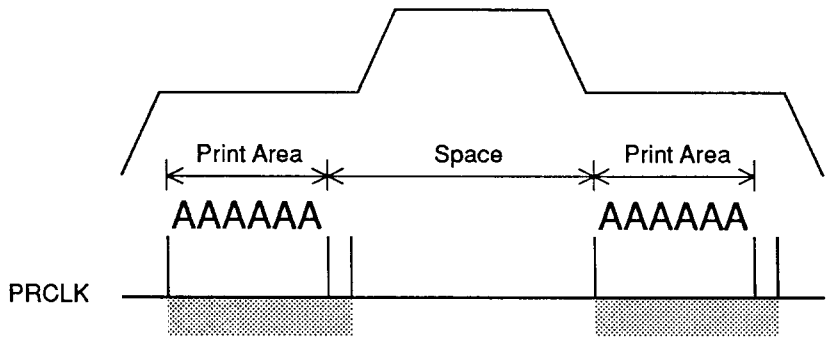


Figure 2.18 Issuing of Print Timing Pulse

NOTE 1. The slave CPU outputs PRCLK only for the print areas indicated by the master CPU. For the space or skip area, no PRCLK will be outputted.

NOTE 2: The print area shall be the actual print area plus the subsequent area between the vertically aligned two pin rows.

(5) Monitoring the sensors

The slave CPU transfers the status of the sensors to the master CPU if any of the sensor status changes or it receives "Request Status" signal from the master CPU.

(6) Sensing the errors

If the slave CPU senses any of the errors listed below, it transfers the error flag and executes the program for processing the detected error.

Error List

Error Type		Detected by
Paper empty error	Rear feed Sheet Bottom feed	RENPE signal (pin 54) TANPE signal (pin 56) BTMPE signal (pin 57)
Cover-open error		CVERS signal (pin 53)
Stepper drive error		ETLALM signal (pin 58)
Head drive error		HDERR signal (pin 30)
Carrier motor encoder error		ENCO1 (pin 75)
Frame width error		
Carriage error		
Carrier motor or paper feed motor error		MBRK signal (pin 73)
Cooling fan error		FANERR signal (pin 60)
Ribbon drive error		RBMALM signal (pin 59)
Paper selection error		During initialization: BOPINI (pin 51) When switching modes: CUSHS (pin 52) (after the paper bail/forms change motor is activated)
Ribbon shift error		SFTINI signal (pin 63)
Head-shift error		SLV25 signal (pin 76)

2.3.4 Gate arrays (μPD65032) for head control

The gate arrays are operable in two modes: Mode 0 (Low level) and Mode 1 (High level), which are switchable according to the signal level of the mode exchange pin (pin 86). Gate array 1 (#19) operates in Mode 0; Gate array 2 (#16) in Mode 1.

The gate arrays mainly control the head drivers by using approximate 80% of its internal circuits. They also control address/data buses of the CPUs, clock pulses, the carrier motor encoder, and decoder circuits for memory and I/O port access of the CPUs.

(1) Block diagram

Figure 2.19 shows a block diagram of the gate arrays and their related circuitry.

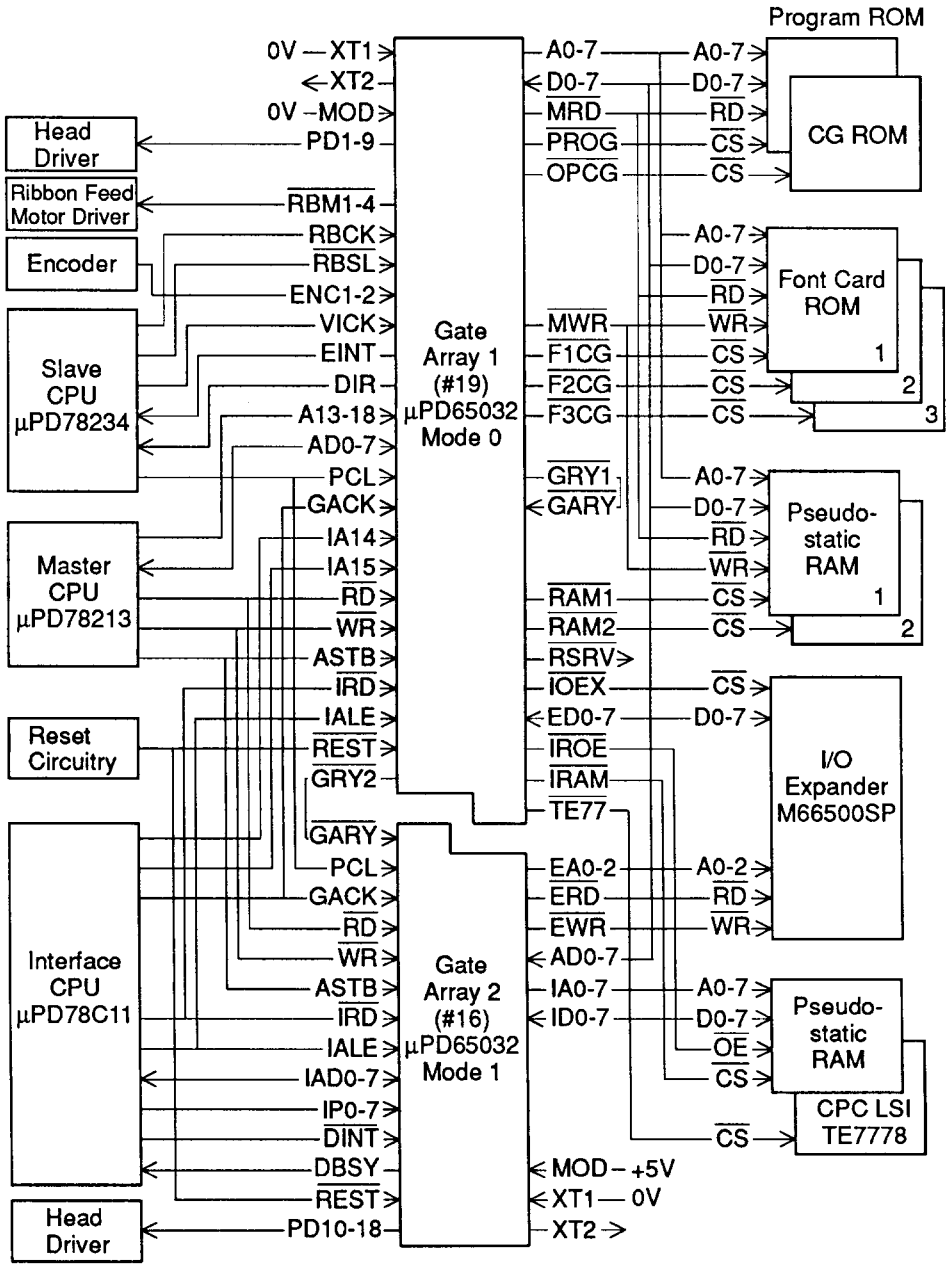


Figure 2.19 Gate Arrays and their Related Circuitry

(2) Pin assignment

What follows is a functional pin assignment of the gate arrays. Signals and description in brackets [ ] are for gate array 2 (#16).

■ Buses

Pin No.	Signals	Functions
86	MOD	Switches the operation mode of the gate arrays between Mode 0 and Mode 1. Low for Mode 0 (#19); High for Mode 1 (#16)
100	1GARYCS [2GARYCS]	Chip select signal of gate array 1 [Chip select signal of gate array 2]
81	RD	Read signal from the master CPU
82	WR	Write signal from the master CPU
83	ASTB	Address strobe signal from the master CPU
42	IRD	Read signal from the interface CPU
43	IALE	Address latch enable signal from the interface CPU
78-71	AD0-AD7 [IAD0-IAD7]	Address/data bus of the master CPU [Address/data bus of the interface CPU]
70-62	A7-A0 [IA7-IA0]	Lower address output of the master CPU latched by ASTB [Lower address output of the interface CPU latched by IALE]
51-43	D0-D7 [ID0-ID7]	Data bus of the master CPU with bidirectional transfer controlled by RD [Data bus of the interface CPU with bidirectional transfer controlled by IRD]
16-8	ED7-ED0 [D7-D0]	Switch panel control data bus of the master CPU [Data bus of the master CPU]
61 60	IA14 [PDT0] IA15 [PDT1]	Input signals of upper address from the interface CPU [Input ports of the master CPU to read data from the interface CPU]
59-54	A13-A18 [PDT2-PDT7]	Input signals of upper address bus from the master CPU [Input ports of the master CPU to read data from the interface CPU]

■ Decoder for CPUs

Pin No.	Signals	Functions
7	PRGCS [EA0]	Chip select signal of the master CPU for the program ROM (128 kilobytes from 00000H to 1FFFFH) [Address bus to control the switch panel]
6	OPCGCS [EA1]	Chip select signal of the master CPU for optional CG (128 kilobytes from 20000H to 3FFFFH) [Address bus to control the switch panel]
5	F1CGCS [EA2]	Chip select signal of the master CPU for Font card 1 (32 kilobytes from 60000H to 67FFFH) [Address bus to control the switch panel]
97	F2CGCS	Chip select signal of the master CPU for Font card 2 (32 kilobytes from 68000H to 6FFFFH)
98	F3CGCS	Chip select signal of the master CPU for Font card 3 (32 kilobytes from 70000H to 77FFFH)
99	1GARYCS [ERD]	Chip select signal of the master CPU for gate array 1 (8 kilobytes from 78000H to 79FFFH) [Read signal to control the switch panel]
3	2GARYCS [EWR]	Chip select signal of the master CPU for gate array 2 (8 kilobytes from 7A000H to 7BFFFH) [Write signal to control the switch panel]
4	IOEXCS [Not used.]	Chip select signal of the master CPU for the switch panel control gate array (8 kilobytes from 7C000H to 7DFFFH)
95	AMRAMCS [Not used.]	Chip select signal of the master CPU for RAM 1 (32 kilobytes from 40000H to 47FFFH)
96	ADRAMCS [Not used.]	Chip select signal of the master CPU for RAM 2 (32 kilobytes from 48000H to 4FFFFH)
87	EXTP	Not used.
32	RAMOE [Not used.]	Output enable signal of the interface CPU for the RAM
33	AIRAMCS [Not used.]	Chip select signal of the interface CPU for the RAM
84	TE7CS [Not used.]	Chip select signal of the interface CPU for TE7778 (#21)

■ Clock control

Pin No.	Signals	Functions
26, 27	XT1, XT2	Not used.
88	GACLK	Basic clock of the gate arrays Clock input of 2.4567 MHz from the interface CPU
85	RESET	Reset signal input to initialize the gate arrays
39	RBMCLK [GND]	Basic clock input to control the ribbon feed motor [Ground]
38	RBMSEL [DINT]	Select signal input to drive the ribbon feed motor [Interrupt signal input from the interface CPU]
89 | 92	RBM1 [Not used.] | RBM4 [DBSY]	Phase drive signal outputs to drive the ribbon feed motor [Output signal to the interface CPU turning High at DINT input]
34	PRCLK	Print timing input from the slave CPU Toggle signal inverting every approx. 278 µs

■ Carrier motor encoder

Pin No.	Signals	Functions
31 30	ENCO1 ENCO2	Input signals from the carrier motor encoder The phase difference between ENCO1 and ENCO2 is 90° [Always Low]
37	VIACK	Input signal from the slave CPU to tell the end of the encoder interrupt Toggle signal of High level at initial state [Always Low]
36	DIRFR	Output signal to tell the carrier travel direction (forward or reverse) To be transferred to the slave CPU in synchronization with signal EINT [Always opened]
35	EINT	Encoder interrupt signal to the slave CPU It turns High at the positive-going edge of ENCO1 when ENCO2 is Low, and turns Low at the positive-going edge of VIACK.

■ Head pin control

The print head has 18 print pins vertically arranged in dual line (9 pins x 2 lines). To print at higher speed, dot data to be printed are distributed to the preceding and following lines of pins at every print column.

In the copy printing mode, the preceding and the following lines of pins print the same dot data onto the same print position at half print speed.

Since the preceding and the following lines of pins are 3.5/72 inch apart, the master CPU generally compensates the print timing delay of the following pins relative to the preceding pins for every print column, and the gate arrays finely adjust it.

Figure 2.20 shows a functional block diagram of the print head control circuit integrated in the gate array. The print timing of the head is under control of the slave CPU. Upon receipt of PRCLK signal from the slave CPU, the gate array starts the head drive timer while the master CPU sets the next print data to the gate array.

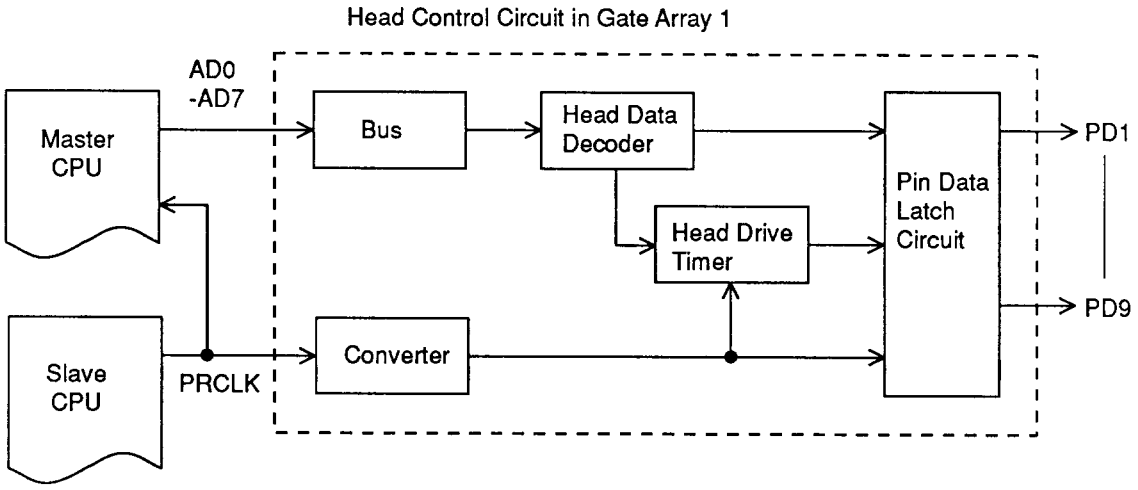
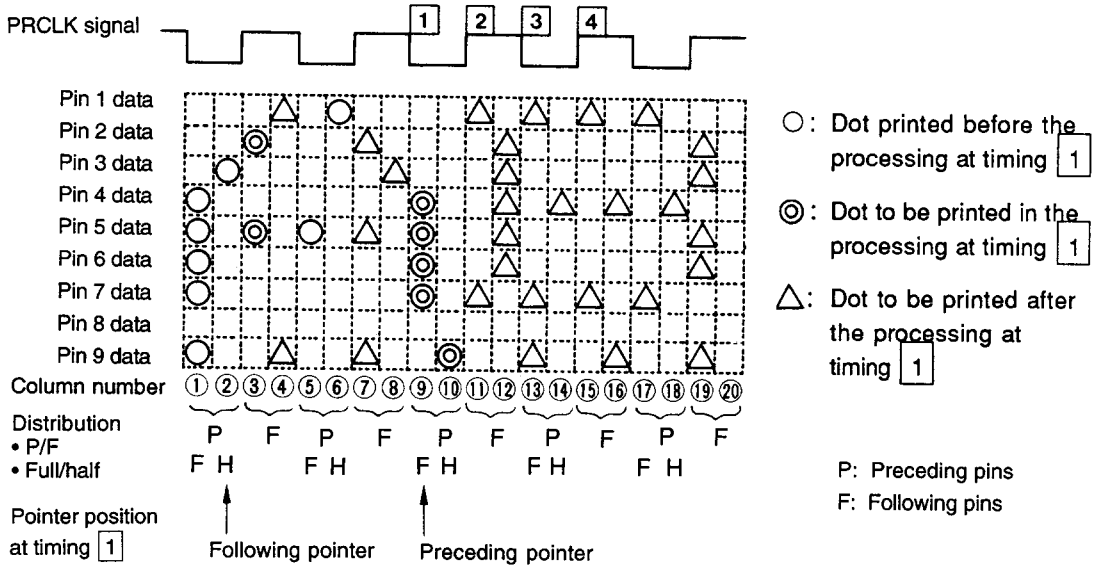


Figure 2.20 Block Diagram of Print Head Control Circuit

[Example of pin data processing at PRCLK interruption]

What follows is an example of the pin data processing in the gate arrays at PRCLK interruption, where the number of delay columns is 7.


PRCLK signal
1
2
3
4
Pin 1 data
Pin 2 data
Pin 3 data
Pin 4 data
Pin 5 data
Pin 6 data
Pin 7 data
Pin 8 data
Pin 9 data
Column number
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
Distribution
• P/F
• Full/half
P F P F P F P F P F
F H F H F H F H F H
Pointer position at timing 1
Following pointer
Preceding pointer
○: Dot printed before the processing at timing 1
◎: Dot to be printed in the processing at timing 1
△: Dot to be printed after the processing at timing 1
P: Preceding pins
F: Following pins

Pin data processing at timing [1] (pointer position ⑨ for the preceding pins; ② for the following pins)

- Sets pin data in column ⑨ onto the full dot position of the preceding pins.
- Sets pin data in ⑩ onto the half dot position of the preceding pins.
- Sets pin data "0" onto the following pins.
- Sets pin data in column ③ onto the half dot position of the following pins.

Pin data processing at timing [2] (pointer position ⑪ for the preceding pins; ④ for the following pins)

- Sets pin data "0" to full dot position of the preceding pins.
- Sets pin data "0" to half dot position of the preceding pins.
- Sets pin data on the column ④ to full dot position of the following pins.
- Sets pin data "0" to half dot position of the following pins.

Pin data processing at timing [3] (pointer position ⑬ for the preceding pins; ⑥ for the following pins)

Same as the processing at timing [1].

Pin data processing at timing [4] (pointer position ⑮ for the preceding pins; ⑧ for the following pins)

Same as the processing at timing [2].

The table below lists the print speed and the required number of delay columns.

Print speed	Dot pitch (Including half dot position) (in inches)	Distance between the preceding and following pins (in inches)	Number of delay columns	Print mode
1	1/ 90	4.38/90	4	HS-DRAFT
2	1/120	5.83/120	5	DRAFT10, 12
3	1/144	7/144	7	PLOTTER 1
4	1/160	7.77/160	7	CRT 1
5	1/180	8.75/180	8	DRAFT15, CRT2
6	1/240	11.67/240	11	DRAFT17, 20, NLQ10, 12
7	1/288	14/288	14	PLOTTER 2
8	1/480	23.33/480	23	NLQ15, 17, 20, initial print

2.3.5 Reset circuitry

Figure 2.21 shows the reset circuitry which uses a system reset IC M51957BFP. If its input voltage (pin 2) drops to 1.25V (reference voltage level) or below, the M51957BFP turns its output (pin 6) Low to reset the control electronics. If the input voltage exceeds 1.25V, the output goes High to release the reset state.

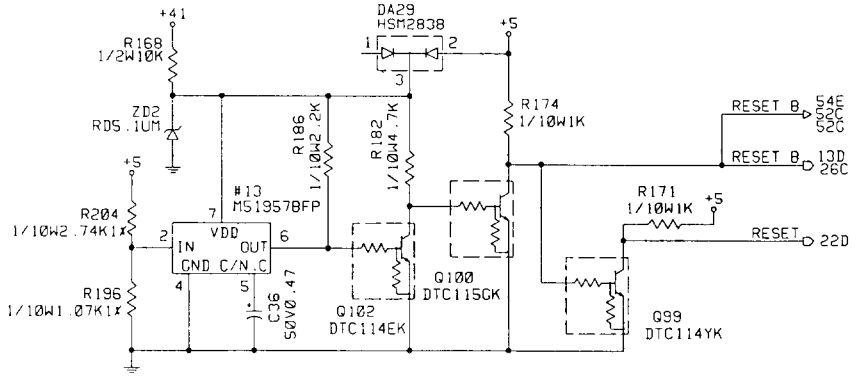


Figure 2.21 Reset Circuitry

Figure 2.22 shows the waveform of the RESET signal, corresponding to the Vcc change. The td represents the time delay for outputting a RESET signal after the input voltage goes higher than the reference voltage. It depends upon the voltage charged in the capacitor connected to pin 4 of the M51957BFP and can be calculated by the formula: $td = 0.34 \times C_{PF}$ µsec.

At powering-on sequence, the reset circuit resets all circuits of the control electronics including CPUs and gate arrays until the +5V source rises up to approx. +4.5V.

At powering-off sequence, the +5V source drops faster than the +41V source so that the reset circuit powered by the +41V source cuts off the P5V output to prevent the power circuits and mechanisms from malfunctioning.

Figure 2.23 shows the circuit diagram of P5V which turns off to cut off the drive current to the head drivers and the motor drivers.

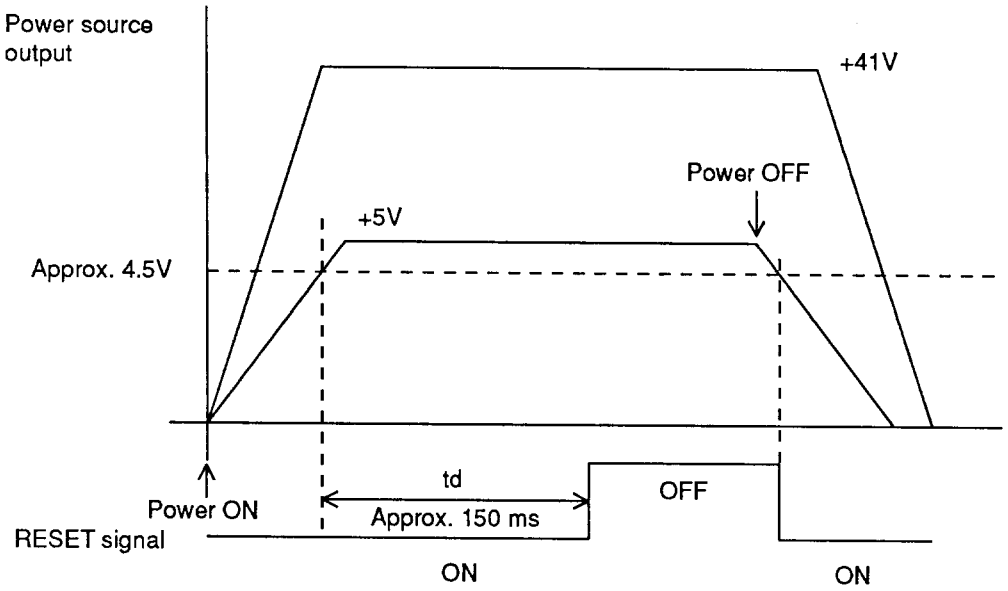


Figure 2.22 Reset Signal Generation

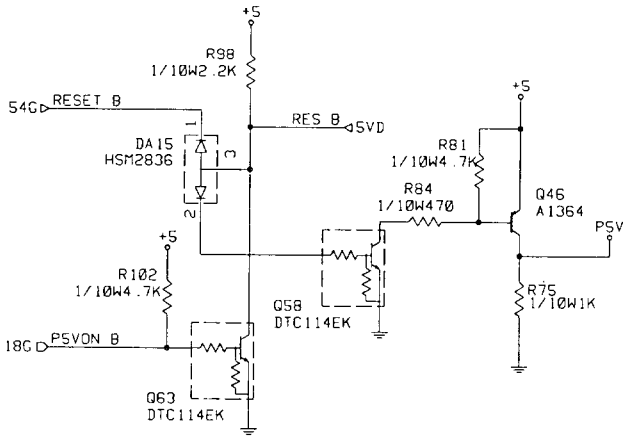


Figure 2.23 P5V Circuit

2.3.6 Head driver

Figure 2.24 shows one of the 18 head driver circuits used in this printer.

To drive the head pins, the master CPU writes print data into the gate arrays first and the gate arrays drive the head driver circuits for the time specified by their internal timers.

The High output of PD01 signal from the gate array turns on transistor Q83 which turns on transistors Q86 and Q70. This operation makes the drive current flow into head solenoid L1 to drive the head pin.

Turning off PD01 signal cuts off transistors Q83, Q86, and Q70. During the cutting-off operation, diodes D54 and D42 provide a path of counter current induced in the solenoid coil.

Figure 2.25 shows the waveforms of the signal PD01 and the head drive current.

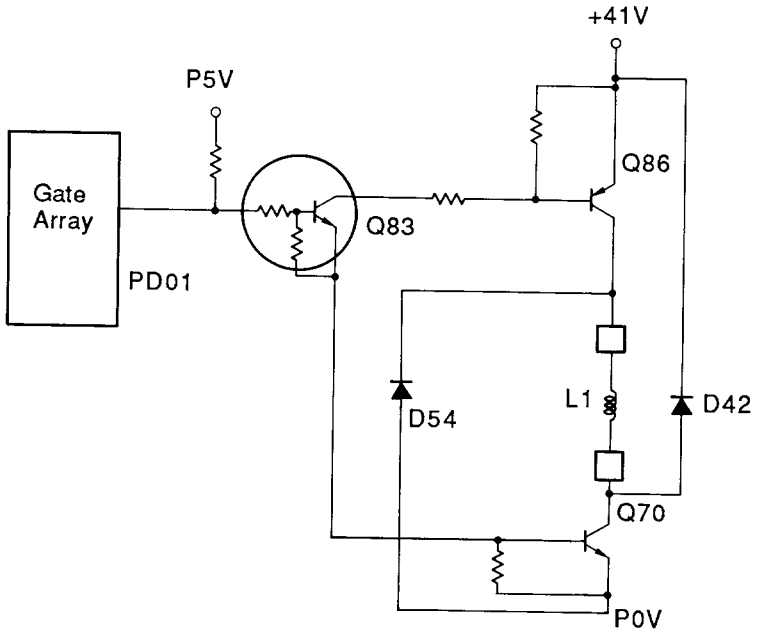


Figure 2.24 Head Driver Circuit

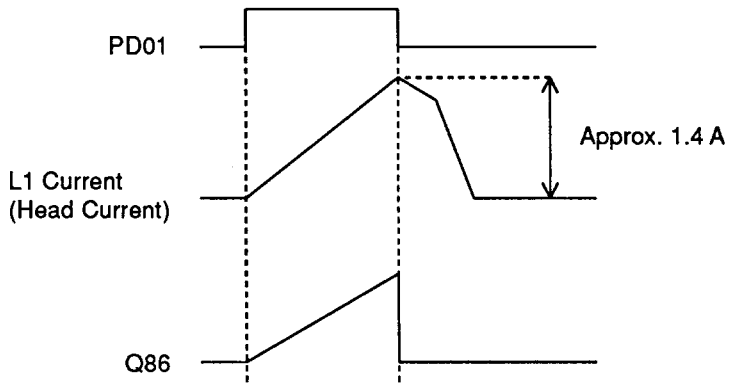


Figure 2.25 Head Drive Signal Waveforms

2.3.7 Paper feed motor driver

The paper feed motor driver shown in Figure 2.26 drives the stepping motor with 2-2 phase unipolar constant current excitation. (Figure 2.26 shows two of the four phase excitation circuits used in this printer.)

Signals LFMSEL and LFM1-LFM4 issued from the slave CPU control the paper feed motor. This circuit switches signals LFM1-LFM4 to give the motor the expected rotation when signal LFMSEL is Low.

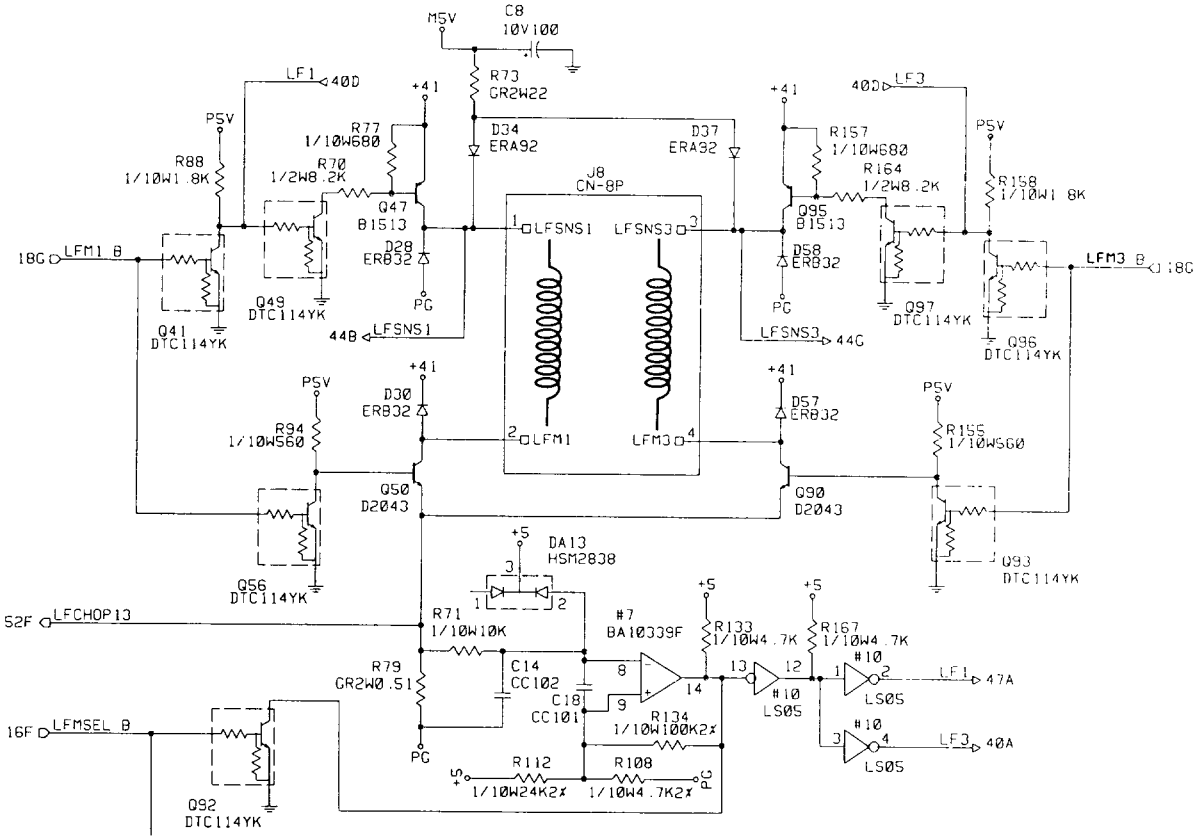


Figure 2.26 Paper Feed Motor Drive Circuitry (Half)

If LFM1 signal turns Low, transistor Q50 turns on to apply drive current into the coil of the paper feed motor. This current flows through resistor R79 (0.51Ω, 2W) whose terminal voltage is checked by comparator BA10339 (#7). If it detects overcurrent, its output LF1 shuts down the drive current to prepare a hardware means of the current limitation at approx. 1.9 A (the detection level of comparator is 0.97V).

When signal LFMSEL is High to idle the paper feed motor, the current from the M5V source flows across the motor coils through register R73 and diode D34 to generate static torque for keeping the paper feed mechanism stable.

Figure 2.27 illustrates typical current waveforms in this circuit.

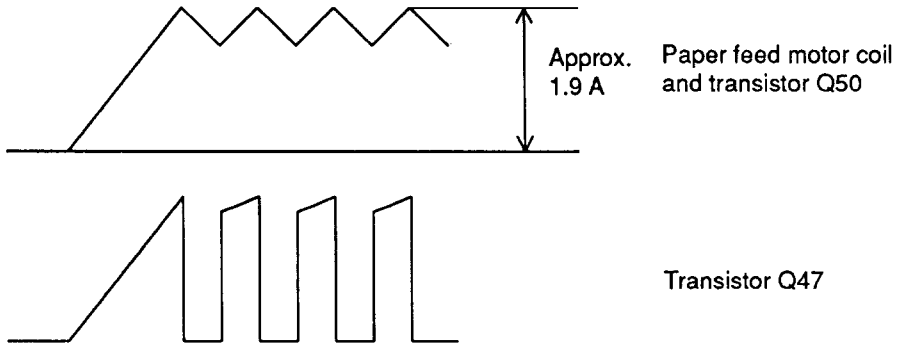


Figure 2.27 Current Waveforms

2.3.8 Carrier motor driver

Signals FWD and REV issued from the slave CPU control the rotation direction of the carrier motor. To rotate the motor in the forward direction, the slave CPU turns signal FWD Low so that transistor Q29 and FET Q39 turn on sequentially to apply the forward drive current to the carrier motor. To rotate the motor in the reverse direction, the slave CPU turns signal REV Low to turn on transistor Q31 and FET Q38.

While the motor is driven, comparator BA10339 (#7) monitors the terminal voltage of resistor R12 and turns its output MCINT Low to cut off the drive current to protect overdrive. This prepares a hardware means for limiting the drive current.

Signal CRREF issued from the slave CPU defines the five current limit levels: that is, approx. 5.9 A for High-speed draft mode, 5.6 A for Draft mode, 3.3 A for High-speed draft copy mode, 2.3 A for NLQ mode, and 5.7 A for all modes at the time of braking carrier.

Figure 2.28 shows the circuit diagram of the carrier motor driver; Figure 2.29, typical driver current waveforms.

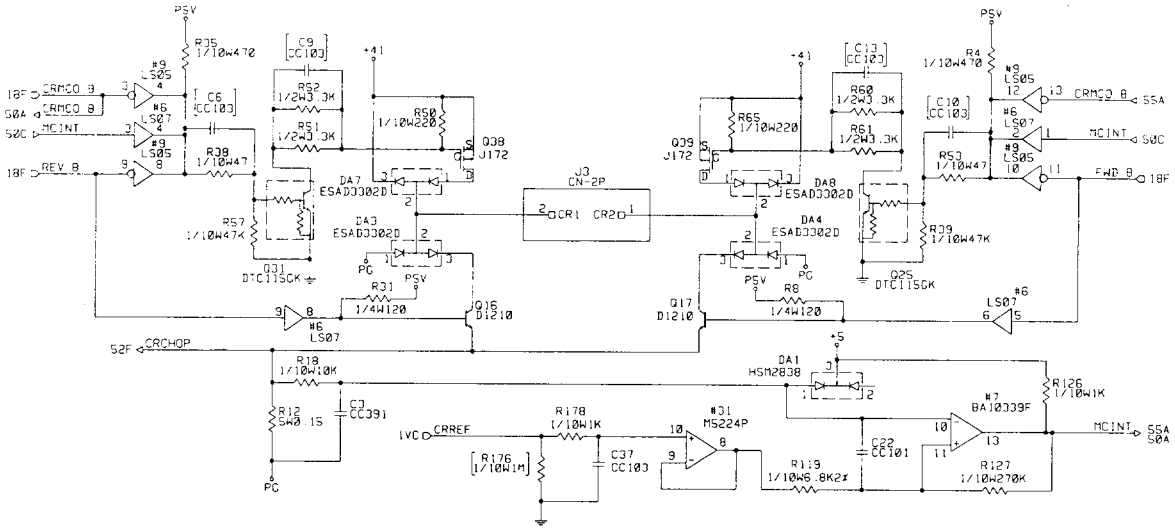


Figure 2.28 Circuit Diagram

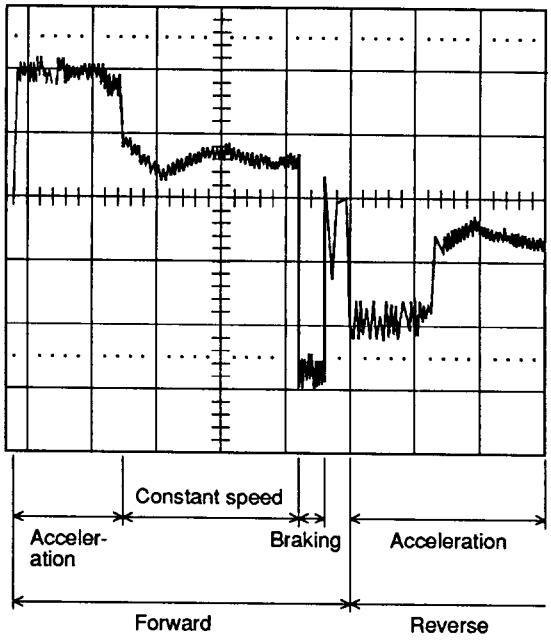


Figure 2.29 Current Waveforms of Carrier Motor in High-speed Draft Mode

2.3.9 Other motor drivers

In addition to the carrier motor and paper feed motor, this printer has the ribbon feed motor, paper bail/forms change motor, head-adjust motor, and ribbon shift motor, which are driven by the same circuit.

Figure 2.30 shows the circuit diagram of the ribbon feed motor driver.

The drive pulses for the ribbon feed motor are generated by gate array 1 (#9); those for other motors are by the slave CPU.

The moment signal RBMSEL goes Low, transistor Q57 turns on to apply drive current to the ribbon feed motor, and signals RBM1-RBM4 turn on the corresponding transistors in transistor array M5248 (#3) to excite the phase coil of the motor.

For the paper bail/forms change motor, head-adjust motor, and ribbon shift motor, the current applied from the M5V source generates static torque to keep the mechanisms stable, as shown in Figure 2.31.

Figure 2.32 shows the absorbing circuit for the counter electromotive force (emf). A single transistor Q24 returns all of the counter emf generated when the drive current of the motors is cut off, to the +41 source.

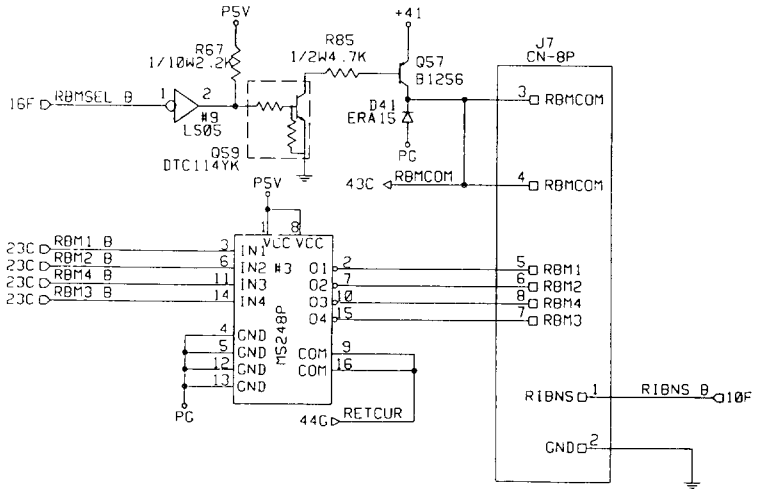


Figure 2.30 Ribbon Feed Motor Driver

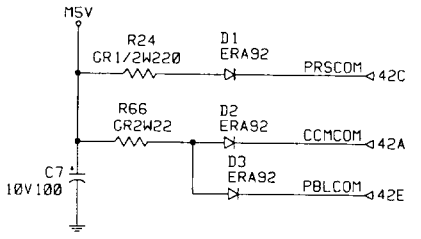


Figure 2.31 M5V Source

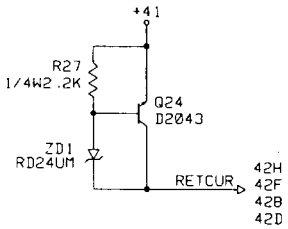


Figure 2.32 Absorbing Counter Emf

2.3.10 Cooling fan driver

Figure 2.33 shows the circuit diagram of the cooling fan driver. If the slave CPU turns FANCNT signal Low, transistor Q13 turns on to drive the cooling fan.

The slave CPU alternates turning on and off FANCNT to reduce the fan speed while the printer is idle.

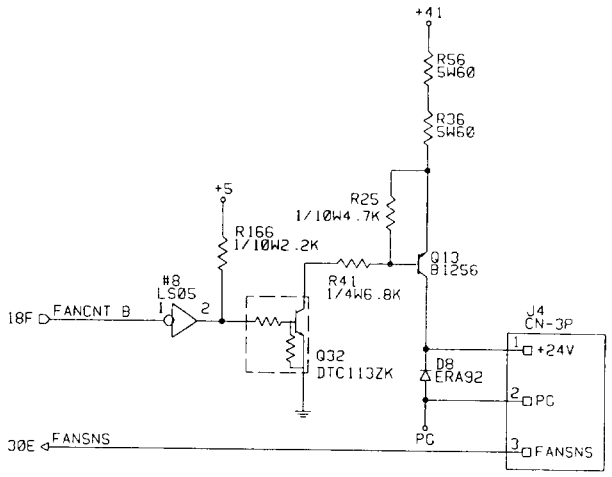


Figure 2.33 Cooling Fan Drive Circuit

2.3.11 Error detectors

This printer integrates the six error detection circuits for:

(1) Head driver transistors

(2) Paper feed motor driver and carrier motor driver

(3) Stepping motor driver transistors

(4) Ribbon feed motor driver transistors

(5) Cooling fan

(6) +41V source output drop

(1) Error detector for the head driver transistors

The detection circuit shown in Figure 2.34 monitors the collector voltage level of the head driver transistors to check them for failure.

The slave CPU reads the output of this circuit, HDERR, while the print head is idle. If the HDERR is Low, the slave CPU interprets it as a transistor failure.

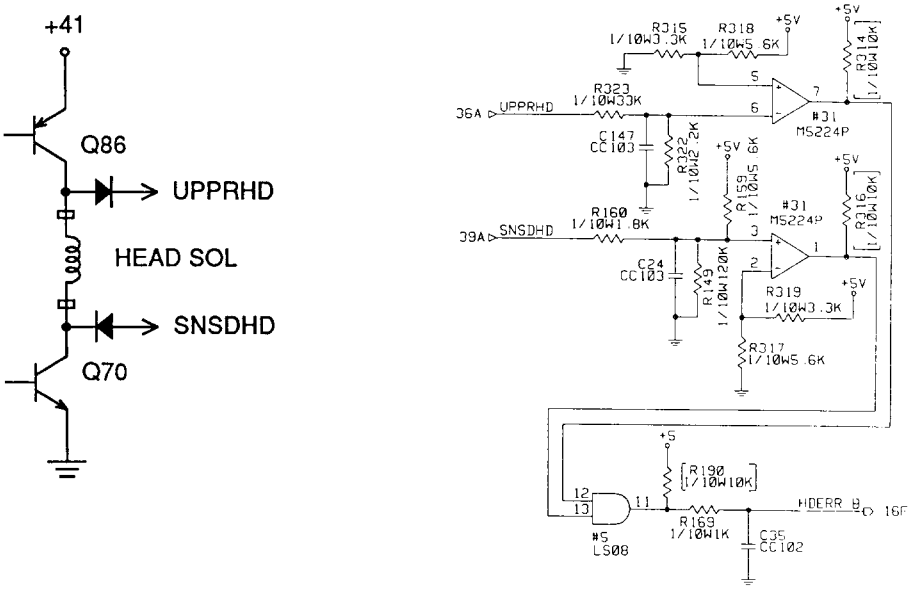


Figure 2.34 Error Detector for Head Driver Transistors

(2) Error detector for paper feed and carrier motor drivers

With comparators BA10339 (#12), the detection circuit shown in Figure 2.35 monitors the terminal voltage levels of the current limiter resistors integrated in the carrier motor and paper feed motor drive circuitry.

If any of the comparators detects the overcurrent (approx. 12.4A for the carrier motor and approx. 2.7A for the paper feed motor), it turns MBRK signal Low. This Low signal interrupts the slave CPU to tell the failure of the circuit.

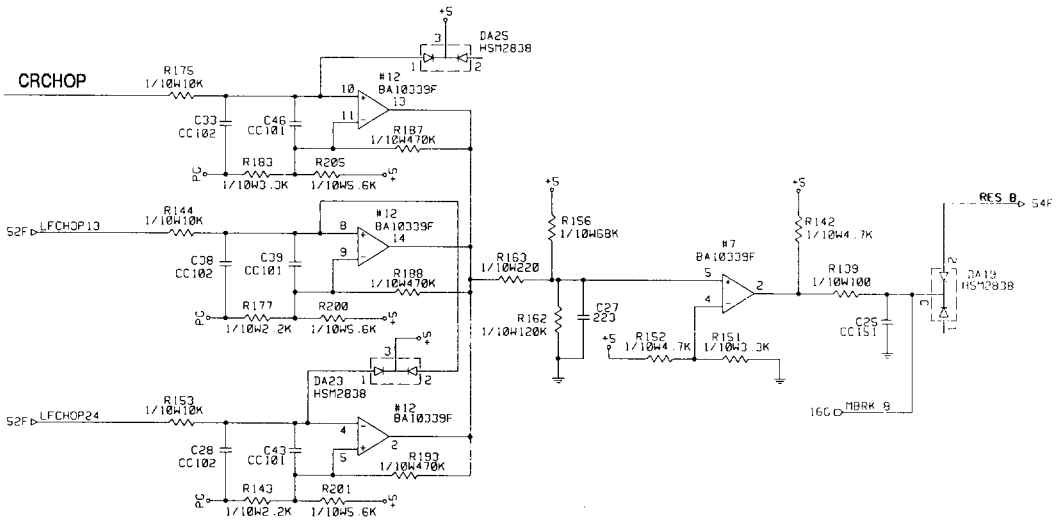


Figure 2.35 Error Detector for Paper Feed and Carrier Motor Drivers

(3) Error detector for the stepping motor driver transistors

Figure 2.36 shows the error detector circuit for the driver transistors of the paper feed motor, ribbon shift motor, head-adjust motor, and paper bail/forms change motor.

The slave CPU monitors the output level of ETLALM while no motor is driven. If the output is 1.8V or more, the slave CPU interprets it as a transistor failure.

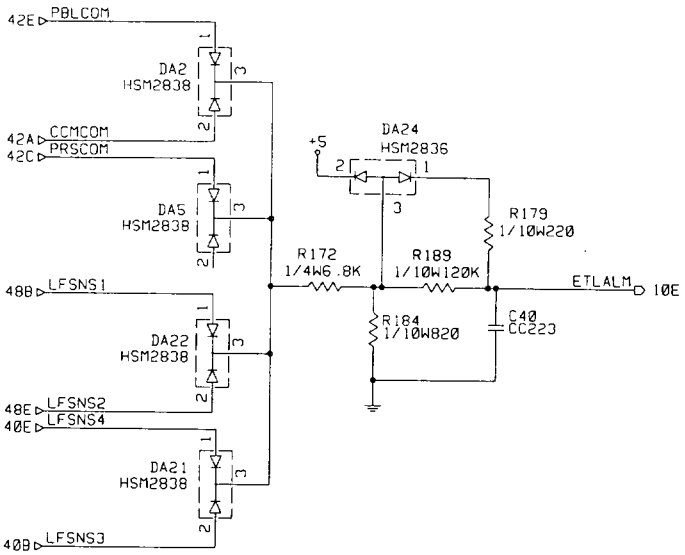


Figure 2.36 Error Detector for the Stepping Motor Drivers

(4) Error detector for the ribbon feed motor driver transistors

The detection circuit shown in Figure 2.37 operates in the same manner as that for the stepping motors described in (3). That is, the slave CPU monitors the output level of RBMALM while the ribbon feed motor is idle. If the output is 1.8V or more, the slave CPU interprets it as a transistor error.

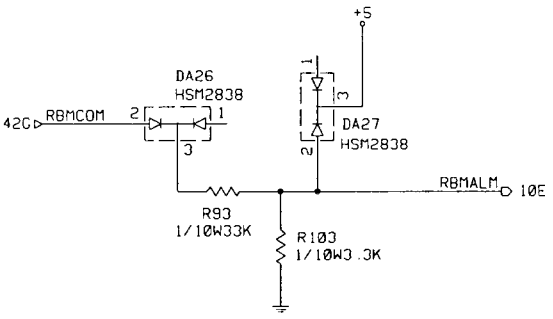


Figure 2.37 Error Detector for Ribbon Motor Driver

(5) Cooling fan error detector

The detection circuit shown in Figure 2.38 monitors FANSNS signal outputted from the internal circuit of the cooling fan and turns its output signal FANERR Low.

The slave CPU monitors the FANERR signal while driving the cooling fan at high speed. Low FANERR tells the slave CPU a cooling fan error (fan locked or disconnected).

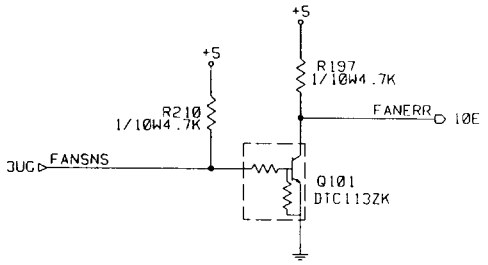


Figure 2.38 Cooling Fan Error Detector

(6) Error detector for the drop of +41V source

The master CPU monitors the output level of the +41V source through the dividing resistors as shown in Figure 2.39. If the master CPU detects 3.4V input or below at pin AN7, it interprets it a +41V source failure.

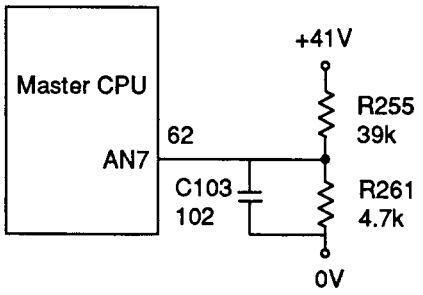


Figure 2.39 Error Detector of +41V Source

2.4 Power Supply Unit

(1) Overview

This power supply unit directly rectifies the AC input from the commercial AC lines and transfers it to the secondary circuitry through the inverter circuit. Figure 2.40 shows the block diagram of the power supply unit.

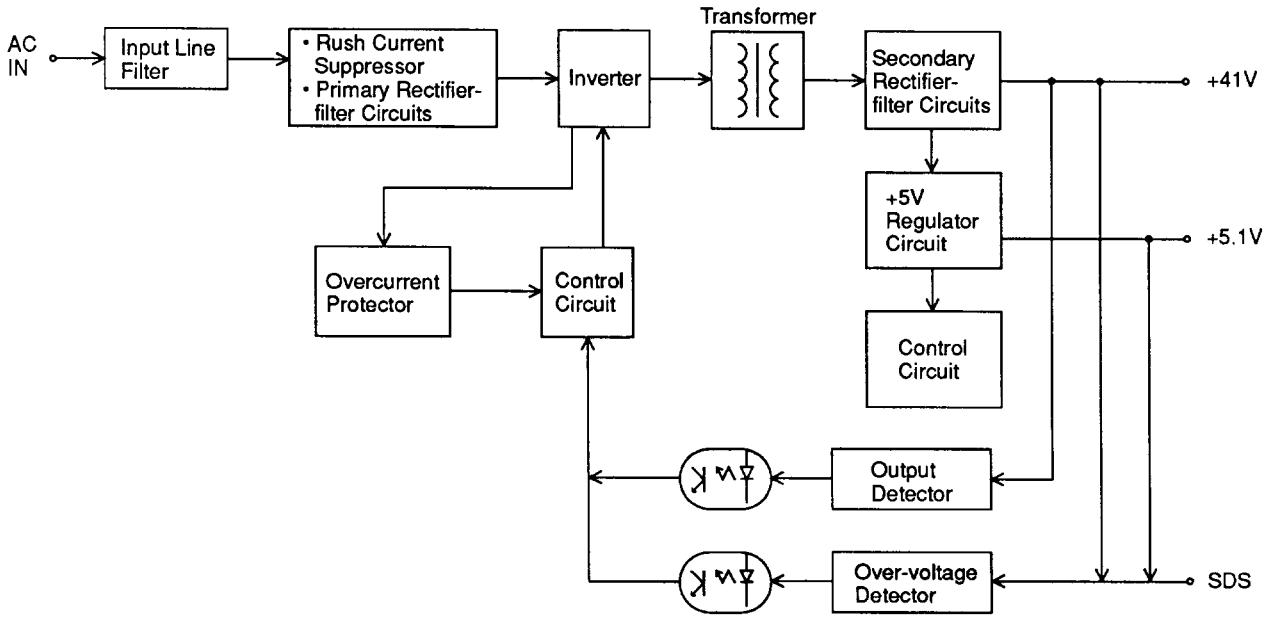


Figure 2.40 Block Diagram of Power Supply Unit

(2) Operation of each configurator

a) Input line filter

The input line filter consists of choke coils and capacitors. This filter eliminates common-mode and normal-mode noises to suppress its flow into the printer or flowback to the commercial power lines.

The common-mode noise generated between the AC lines and the grounding flows through capacitors C4 and C5 to the grounding. The normal-mode noise superimposed on the AC input lines or output lines are attenuated by the filters composed by capacitors C1, C2, C6, and choke coils L1 and L2. Resistor R1 is to discharge capacitors C1, C2, and C6.

2) Rush current suppressor and rectifier circuit

The direct rectifying system may flow large rush current into filter capacitor C8 to be charged up when the power is first applied, so that the power switch contact or others will melt. To prevent such failures, this circuit is designed to flow input current through resistor R2 and suppress the rush current by the resistance of resistor R2.

If the frequency converter starts oscillation, the primary power controller fires triac CR1 to make the current bypass R2, preventing R2 from overheating during normal printing operation.

Rectifier RC1 and capacitor C8 comprise a full-wave rectifier circuit to convert commercial AC input to the direct current.

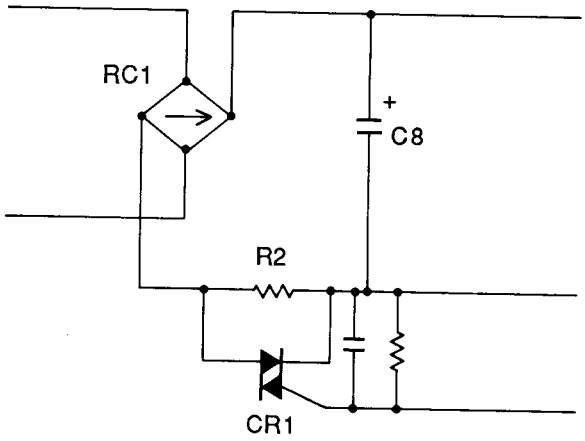


Figure 2.41 Rush Current Suppressor and Rectifier Circuit

c) Reverse converter circuit (RCC)

Figure 2.42 shows the reverse converter circuit called RCC, which conveys the primary power to the secondary circuit when the FET Q1 is turned on.

The signal sent from the primary control circuit switches Q1 on or off to output a pulse train whose typical waveform is shown in Figure 2.43.

Zener diode NR2, diode D1, and capacitor C14 comprise a circuit for flowing excessive counter electromotive force (emf) induced when Q1 is turned off.

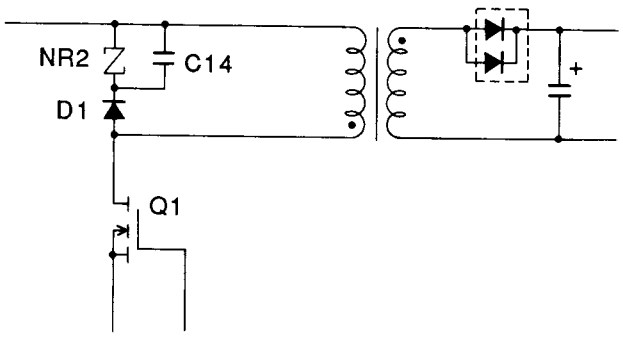


Figure 2.42 Reverse Converter Circuit

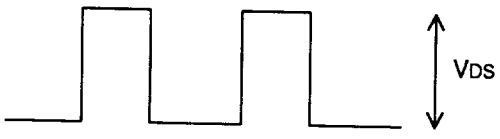
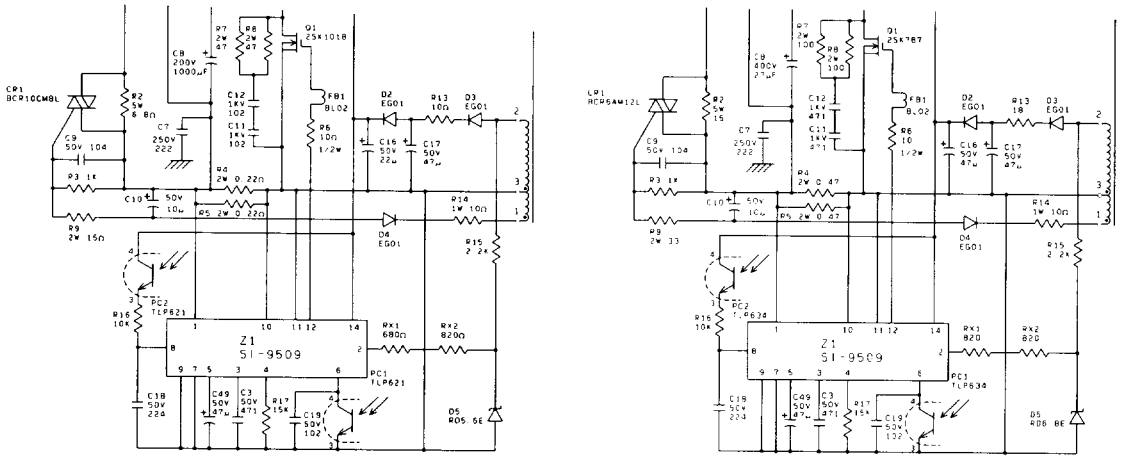


Figure 2.43 Oscillation Waveform

d) Primary control circuit

As shown in Figure 2.44, the control HIC (Z1) monitors the secondary output level detected by the detector circuit through the photocoupler (PC1) insulating the primary circuit from the secondary one, and controls the gate voltage level of FET Q1 to stabilize the secondary output.



100V series
nominal AC input

200V series
nominal AC input

Figure 2.44 Primary Control Circuit

e) Secondary rectifier and filter

Figure 2.45 shows the secondary rectifier and filter circuit. Converter transformer T1 transfers a high frequency pulse train generated in the primary inverter to the secondary circuit. Diode RC rectifies the secondary output and capacitor C filters it to produce the specified DC voltage.

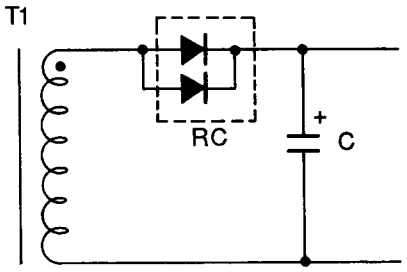


Figure 2.45 Secondary Rectifier and Filter

f) +5.1V regulator circuit

Transistor Q2 switches the DC source obtained in e) to get +5.1V DC power source. This regulation method is generally called chopper method. Control IC (Z2) monitors the output and controls transistor Q2 to stabilize the output voltage.

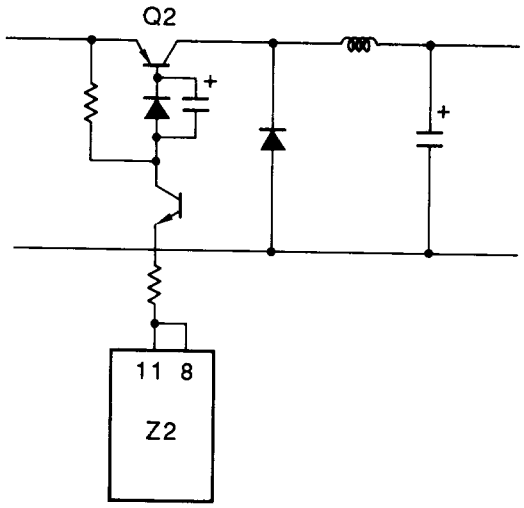


Figure 2.46 +5.1V Regulator Circuit

g) Overcurrent protector

With the characteristics of this power supply unit as described above, the power supply circuit determines the current consumption in the primary circuit. Figure 2.47 shows the overcurrent protector.

If the drain current of FET Q1 measured by resistors R4 and R5 (0.22Ω for 100 V models and 0.47Ω for 200 V models) exceeds the specified level, the control HIC (Z1) shuts down the secondary output.

Control IC (Z2) monitors the +5V output current at the terminal voltage of R26. If it detects overcurrent, Z2 controls the base current of Q2 to shut down the output.

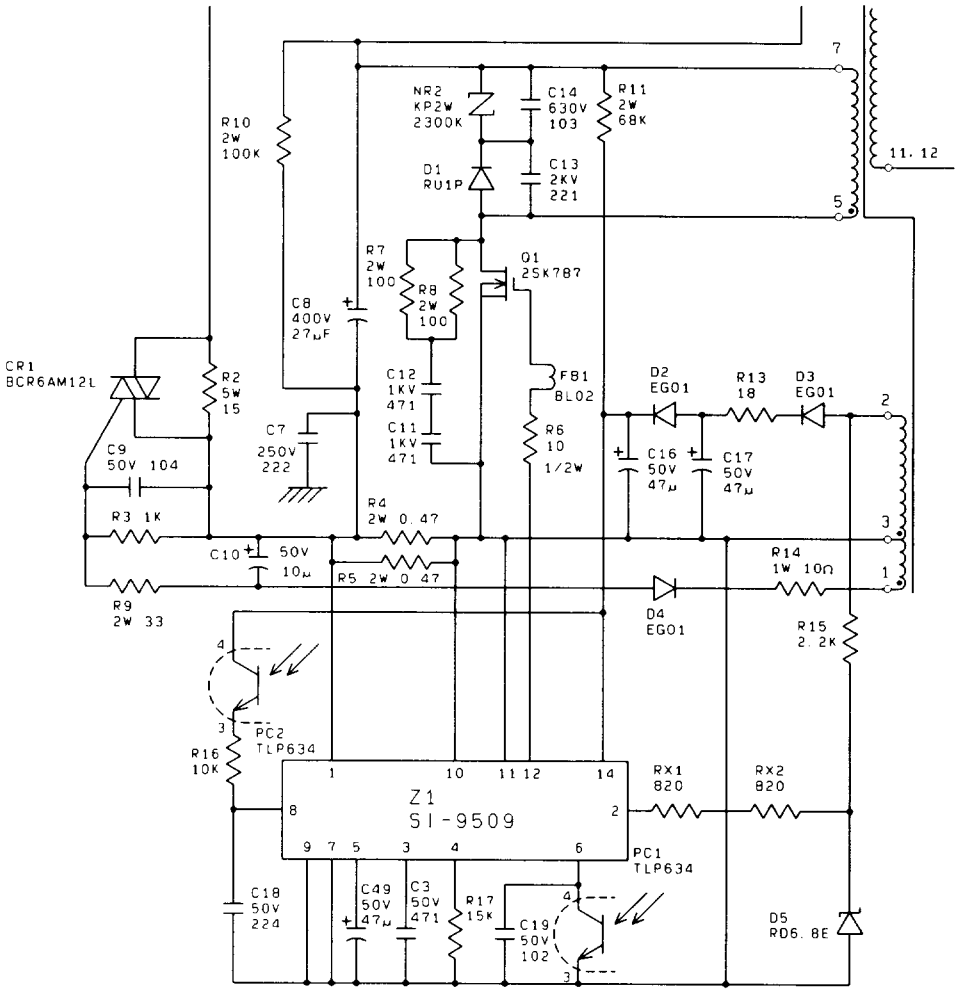


Figure 2.47 Overcurrent Protector

h) Overvoltage protector and SDS signal

Zener diodes (D10 and D9) detect overvoltage in outputs +5V and +41V, respectively, and signal the control HIC (Z1) the overvoltage state through photocoupler PC2 to stop oscillation of Q1.

Since this overvoltage protection is latched in the control HIC (Z1), the next powering-on/off operation only can reactivate this power supply unit. (The powering-off time should be the minimum of 2 or 3 minutes.)

If signal SDS goes High, Zener diode D15 is turned on so that transistors Q5 and Q6 are fired. Accordingly, SDS is inputted to the control HIC (Z1) through PC2. This procedure is the same as that on the above overvoltage protection.

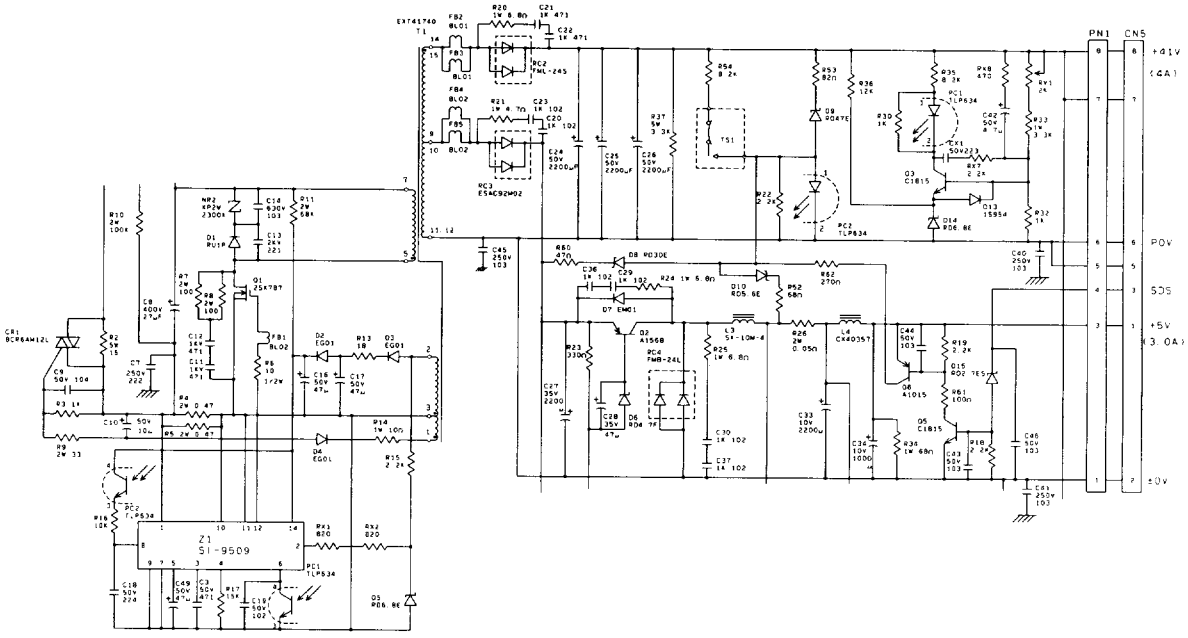


Figure 2.48 Overvoltage Protector

CHAPTER III.

MAINTENANCE

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1. SAFETY PRECAUTIONS

To prevent the creation of secondary problems by mishandling, observe the following precautions prior to maintenance work.

(1) All maintenance works should be carried out by personnel who have completed the technical service training course for high-speed printers, or equivalent.

(2) Never perform printing operations when there is no paper or no ribbon cassette in the printer.

(3) Put nothing on top of the covers while printing or performing maintenance work.

(4) Always unplug the power cord from the power outlet before replacing parts or units.

(5) Be careful not to lose screws, washers, or other parts removed for parts replacement.

(6) When replacing parts, use new parts designed exclusively for the particular application.

(7) When using soldering irons and other heat-generating tools, take care not to damage the resin parts such as wires, PCBs, and covers.

(8) Before handling the PCBs, touch a metal portion of the equipment to discharge static electricity, or the electronic parts may be damaged due to the electricity charged in your body.

(9) When transporting PCBs, be sure to wrap them in conductive sheets such as aluminum foil.

(10) After repairs, check not only the repaired portion but also that the connectors and other related portions function properly before operation checks.

2. PREVENTIVE MAINTENANCE

Performing the preventive maintenance (described below) properly allows the printer to work longer and more efficiently, thereby resulting in longer Mean Time Between Failure (MTBF).

CAUTION: If the external surfaces of the printer are smudged, use a cloth which has been dampened with a mild detergent and water solution. Never use alcohol, thinner, or other organic solvents. These fluids may mar the plastic finish.

■ Cleaning and Lubrication

CAUTION:
- Do not apply excessive amounts of lubricant. Otherwise, the lubricant may spatter or overflow.
- Never lubricate points not appearing on the list below.
- Keep the paper path free of all lubricants.
- Never apply lubricant to the platen, the rollers, and PCBs.
- Limit grease to a thin coat made with a brush. Remove any excess.

Items	Frequency
(a) Main and sub carrier rails	Yearly and before reassembly

■ Adjustment

Items	Frequency
(a) Gap between the print head and the platen (required only for the models equipped with an automatic head-adjust mechanism.) (b) Carrier timing belt	Yearly and before reassembly

2.1 Cleaning and Lubrication

If the main or sub carrier rail is excessively smudged, clean and lubricate it even if one year has not yet passed since the last maintenance work.

Tools and lubricants Gauze, Floil 946P (Kanto-kasei), and Turbine oil #90 (Nisseki, FBK-32)

Procedure

(1) Remove the top cover. (Refer to Section 3.2.1.)

(2) Moving the carrier to the right and left by hand, clean the main and sub carrier rails with a gauze.

NOTE: Do not wipe away lubricant on these carrier rails.

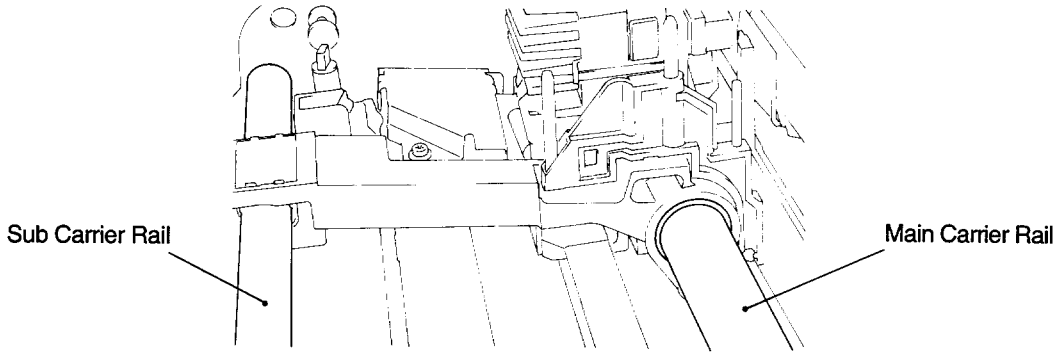


Figure 2.1 Cleaning the Carrier Rails

(3) Clean both ends of the bearing in the carrier.

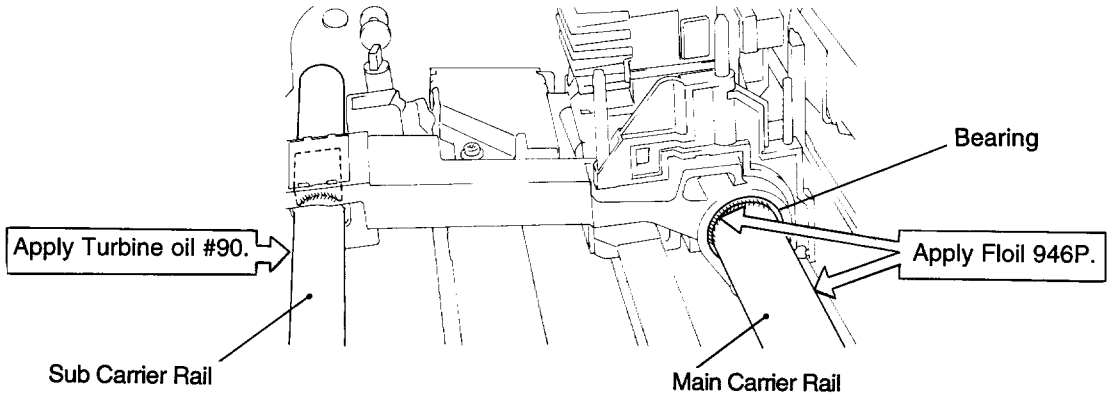


Figure 2.2 Cleaning the Bearing in the Carrier

(4) After cleaning, lubricate the circumference of the bearing in the carrier and the main carrier rail with Floil 946P.

Also lubricate the sub carrier rail with Turbine oil #90 (Nisseki FBK-32).

NOTE: When lubricating the carrier rails, move the carrier to the right and left so that both rails are entirely lubricated.

2.2 Adjustment

2.2.1 Gap between the print head and the platen

(Required only for those models equipped with an automatic head-adjust mechanism.)

Before making this adjustment, be sure to clean the main and sub carrier rails as described in Section 2.1.

Tools Wire gauge (ø0.37 mm) and Phillips screwdriver No. 2

Procedure

(1) Make the head-platen gap compensation, by referring to Subsection 4.1.2, [2], (B).

(2) Move the carrier to approx. 10 mm from the left end of the platen.

(3) Check that the gap between the print head and the platen is 0.37 mm with the wire gauge.

(4) If the gap is not 0.37 mm, turn the manual head-adjust gear by hand to provide the specified gap.

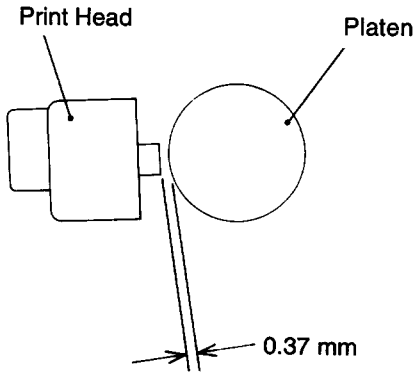


Figure 2.3 Checking the Head-to-platen Gap

(5) Loosen the screw securing the head-adjust scale and turn the scale so that the pointer of the manual head-adjust gear is aligned with position "1" on the scale. Then, tighten the screw.

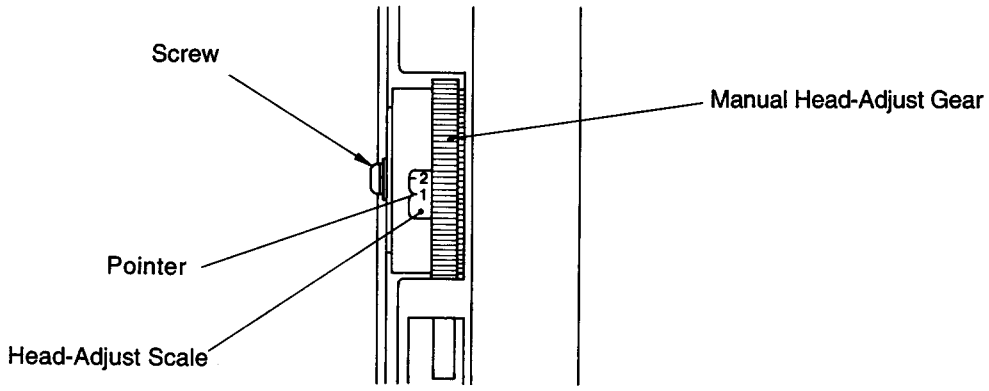


Figure 2.4 Adjusting the Head-adjust Scale

(6) Make the head-platen gap adjustment, by referring to Subsection 4.1.2, [2], (A).

2.2.2 Carrier timing belt

Tools Bar tension gauge (0-500 g), Ruler, Phillips screwdriver No. 2, and Two spanners (7 mm subtense distance)

Procedure

(1) Remove the top cover, the rear cover, and the body cover. (Refer to Section 3.2.1.)

(2) Moving the carrier by hand, check visually that the carrier timing belt is not scarred, frayed, or otherwise damaged.

(3) Move the carrier to the right end of its travel.

(4) Apply a vertical load of 300 g to the center of the belt span.

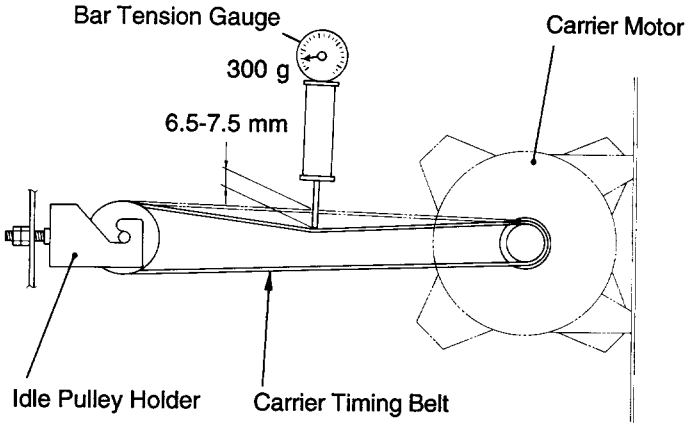


Figure 2.5 Checking the Carrier Timing Belt Tension

(5) Check that the belt deflection is within the range from 6.5 mm to 7.5 mm.

(6) If the deflection is not within the specified range, remove the two front chassis pressure plates (refer to Figure 3.10) and lift up the front end of the chassis unit to support it with the platen knob as shown in Figure 2.6.

(7) Loosen the outer nut, then turn the inner nut to adjust the idle pulley holder so that the belt deflection is within the specified range.

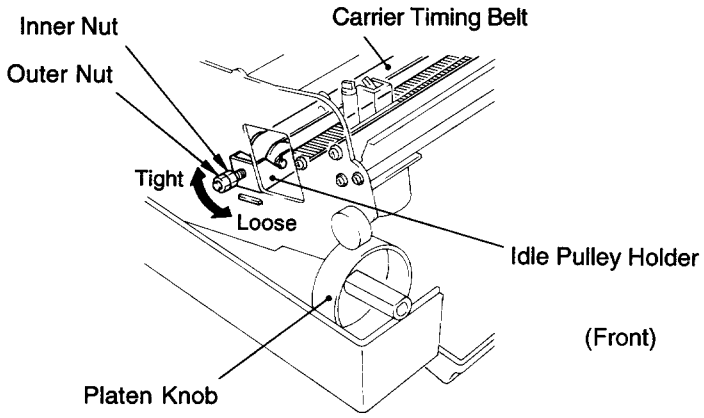


Figure 2.6 Adjusting the Idle Pulley Holder

(8) Tighten the outer nut while taking care not to turn the inner nut.

3. PARTS REPLACEMENT

This section describes the replacement procedures for each major part or unit.

WARNING: Always unplug the printer power cord from the AC outlet before disassembling printer parts.

- If an optional Cut Sheet Feeder is installed on the printer, remove the Feeder from the printer in advance.
- If an optional tractor feeder is mounted on the top of the printer, remove it from the printer in advance.
- Remove any form currently in the printer, by pressing the EJECT switch or turning the platen knob

The tables below list the maintenance tools and applicable lubricants required for this printer.

Maintenance Tools	Specifications
Flat-nose pliers	
Tweezers	
Bar tension gauge	0-500 g
Ruler	
Phillips screwdriver	No. 1
Phillips screwdriver	No. 2
Flat screwdriver	
Spanners	2 spanners with 7 mm subtense distance
Wire gauge	ø0.37 mm and ø0.3 mm
IC pull-out	
Paper pan positioning jig	

Applicable Lubricants	Specifications
Turbine oil #90 (FBK-32)	Nisseki
Floil 946P	Kanto-kasei
Epinoc grease AP1	Nisseki
Permawick	Daido-permawick

3.1 Print Head

a. Removal

(1) Turn up the top cover and pull it upwards.

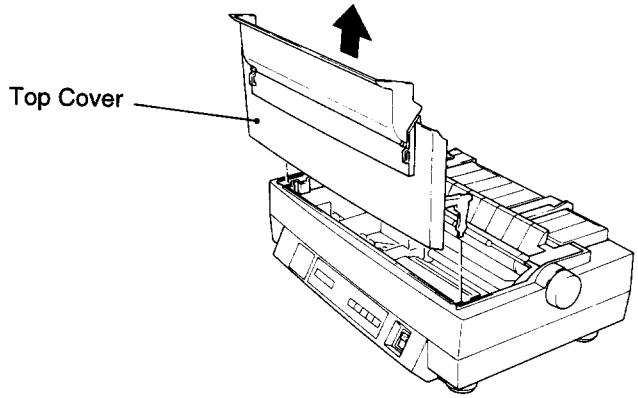


Figure 3.1 Removing the Top Cover

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the two screws (a) securing the print head.

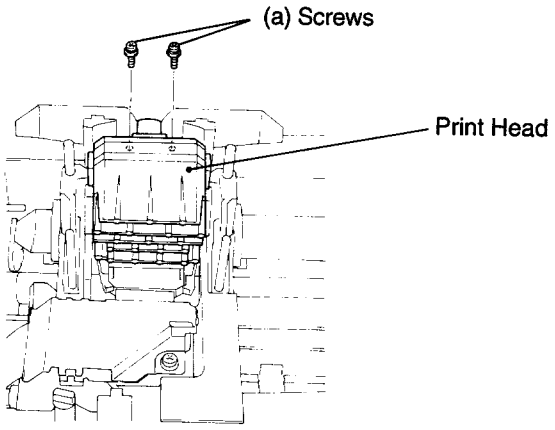


Figure 3.2 Removing the Screws from the Print Head

(4) Disconnect the head cable connector by opening the locks as shown below.

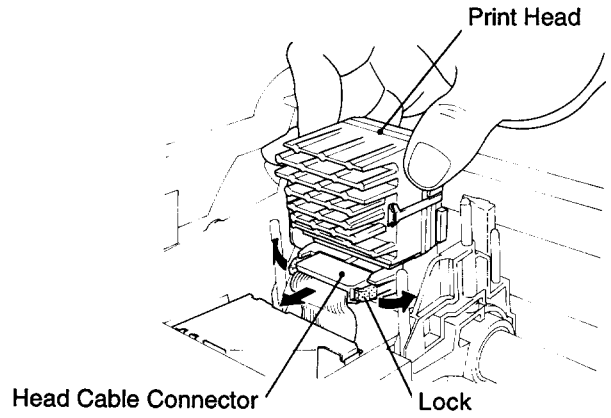


Figure 3.3 Disconnecting the Print Head Cable

b. Installation

(1) If the print head is replaced with a new one, apply Floil 946P packed with the new head to each of the two holes in the carrier.

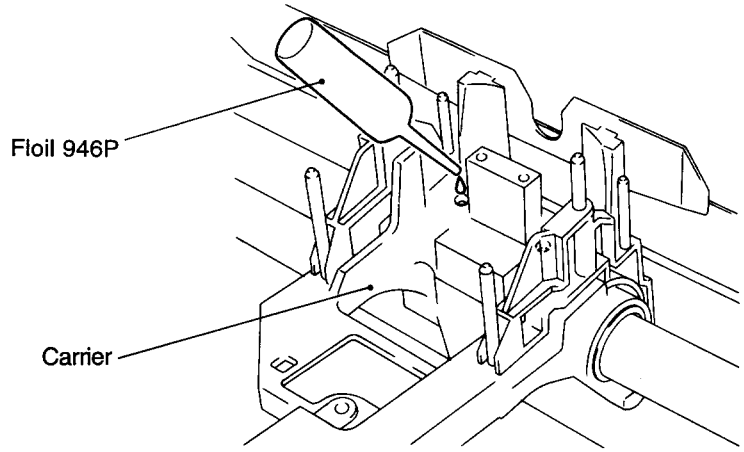


Figure 3.4 Applying Oil to the Carrier

(2) Connect the head cable to the print head and lock the connector. (Refer to Figure 3.3.)

(3) Place the print head on the carrier.

(4) While pressing the print head towards the front of the printer, tighten the two screws (a).

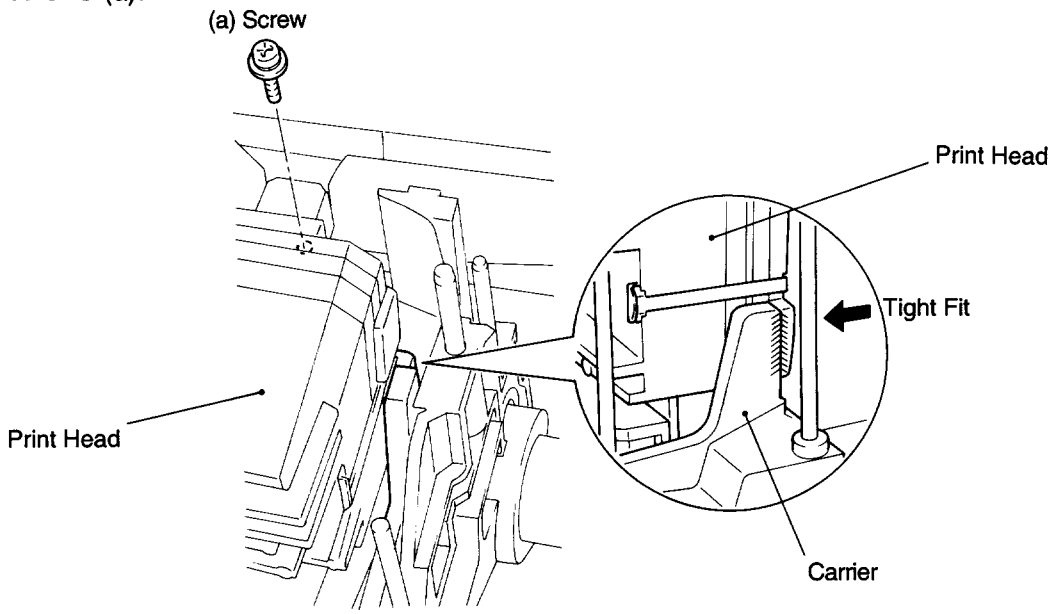


Figure 3.5 Installing the Print Head

(5) Make sure that the contact face of the print head is tightly fitted onto that of the carrier.

(6) For those models equipped with the automatic head-adjust mechanism, make the head property compensation by referring to Subsection 4.1.2, [2], (D).

3.2 Covers

3.2.1 Top cover, rear cover, and body cover

a. Removal

(1) Make sure that no form is present in the printer.

(2) Turn off the POWER switch and disconnect the power cord from the printer.

(3) Turn up the top cover and pull it upwards.

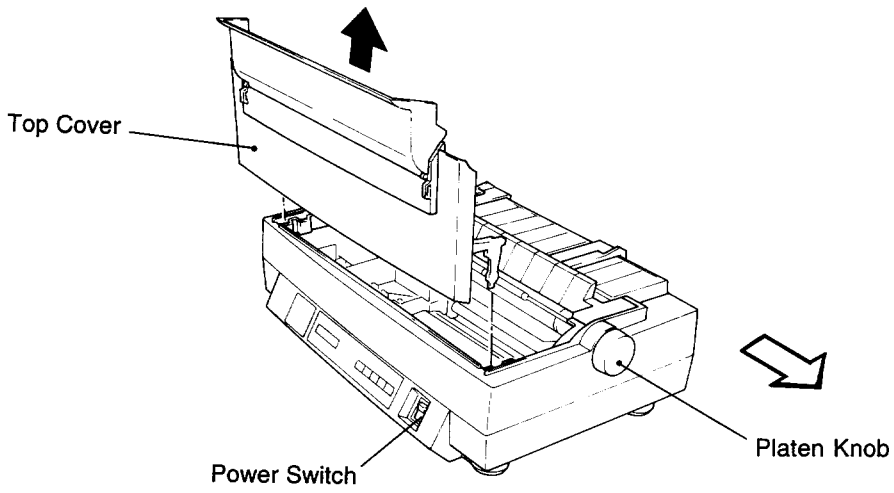


Figure 3.6 Removing the Top Cover and Platen Knob

(4) Pull up the ribbon guide and remove the ribbon cassette.

(5) Pull out the platen knob.

(6) Turn up the rear cover to the vertical position and remove it towards the rear of the printer.

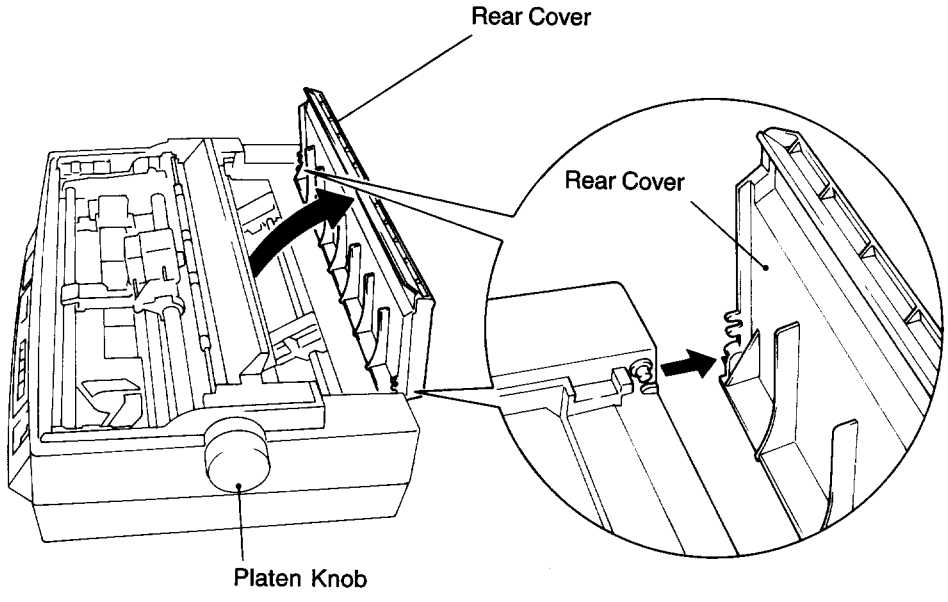


Figure 3.7 Removing the Rear Cover

(7) Remove the four screws (b) and take the body cover up and out of the printer.

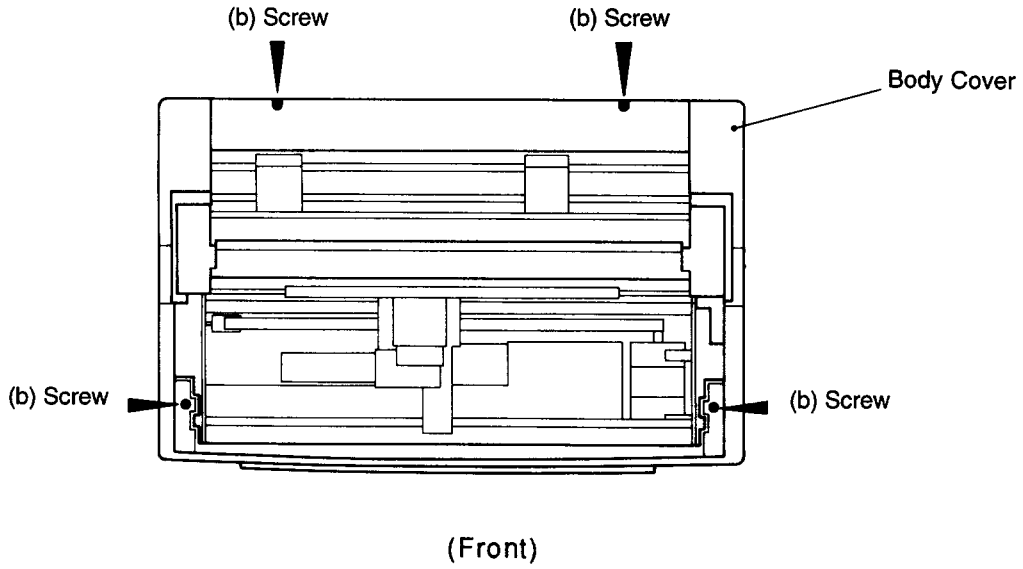


Figure 3.8 Removing the Body Cover

b. Installation

Reverse the removal procedure.

NOTE: When reinstalling the body cover, press the switch panel cover so that the body cover is fitted over the switch panel cover.

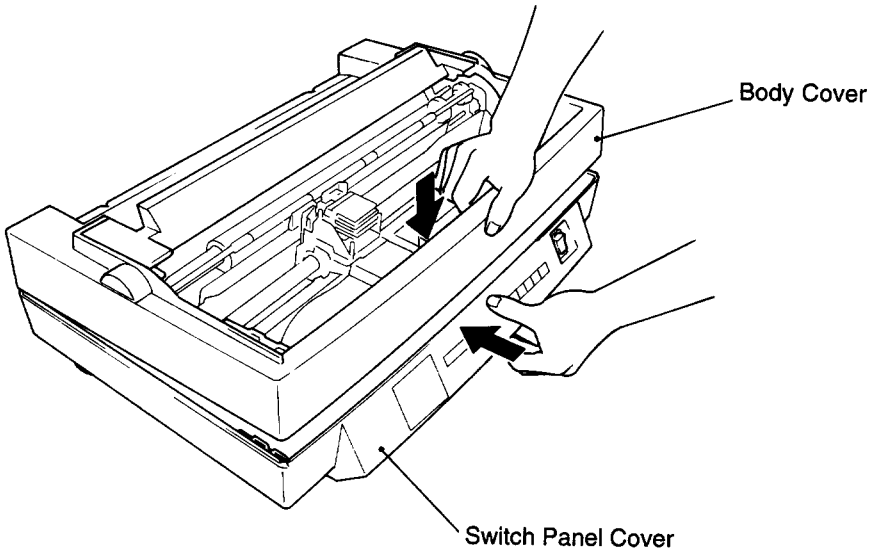


Figure 3.9 Installing the Body Cover

3.2.2 Switch panel cover

a. Removal

(1) Remove the body cover. (Refer to Subsection 3.2.1.)

(2) Open the ribs provided on the bottom cover and slide the chassis pressure plate outwards. (There is one on each side of the front end of the chassis.)

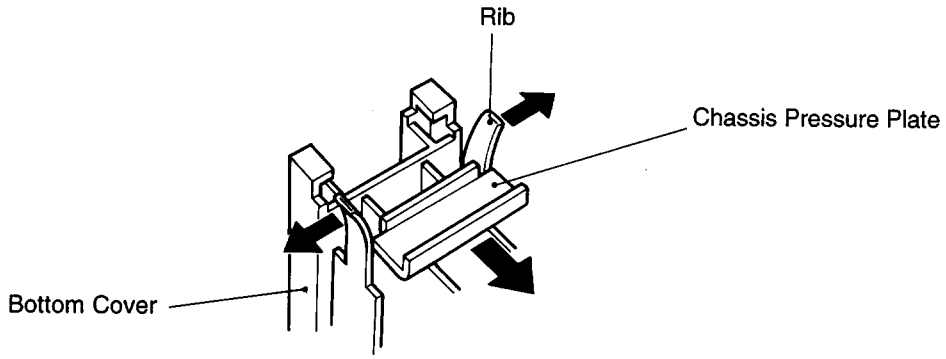


Figure 3.10 Removing the Chassis Pressure Plates

(3) Raise the front end of the chassis unit and support it with the platen knob.

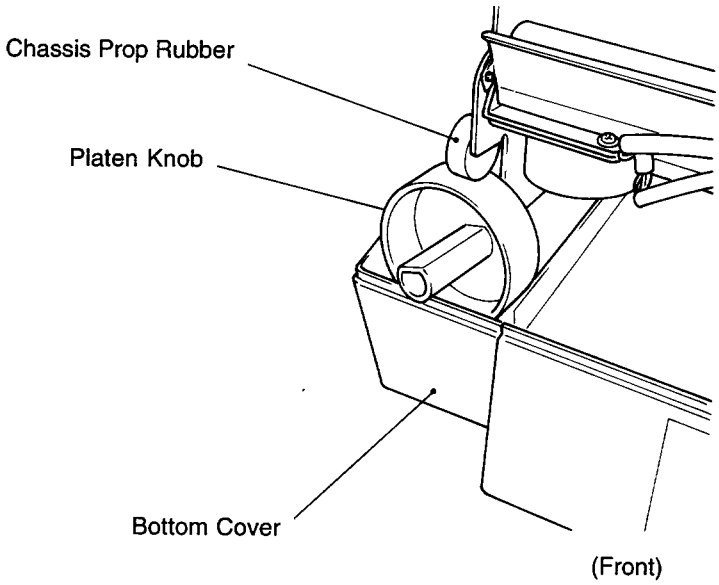


Figure 3.11 Supporting the Front End of Chassis with the Platen Knob

(4) Disengage the hook of the switch panel cover from the bottom cover in the direction of the arrow shown in Figure 3.12. Then, remove the switch panel cover by tilting it towards the front of the printer as shown in Figure 3.13 while taking care not to damage the cover switch harness.

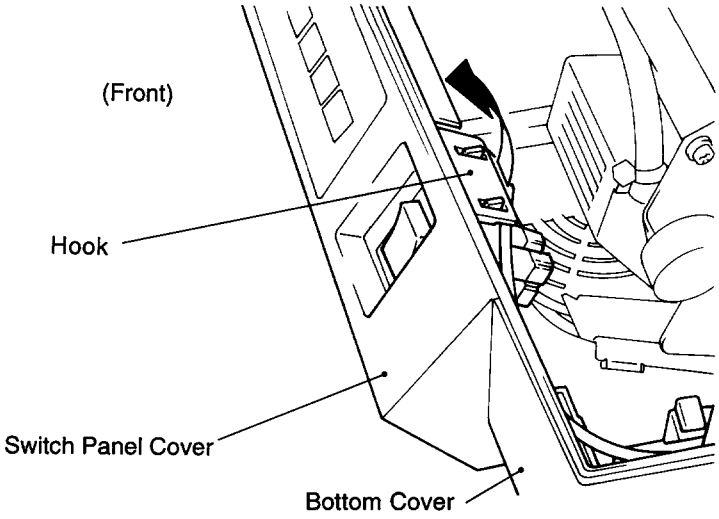


Figure 3.12 Disengaging the Switch Panel Cover

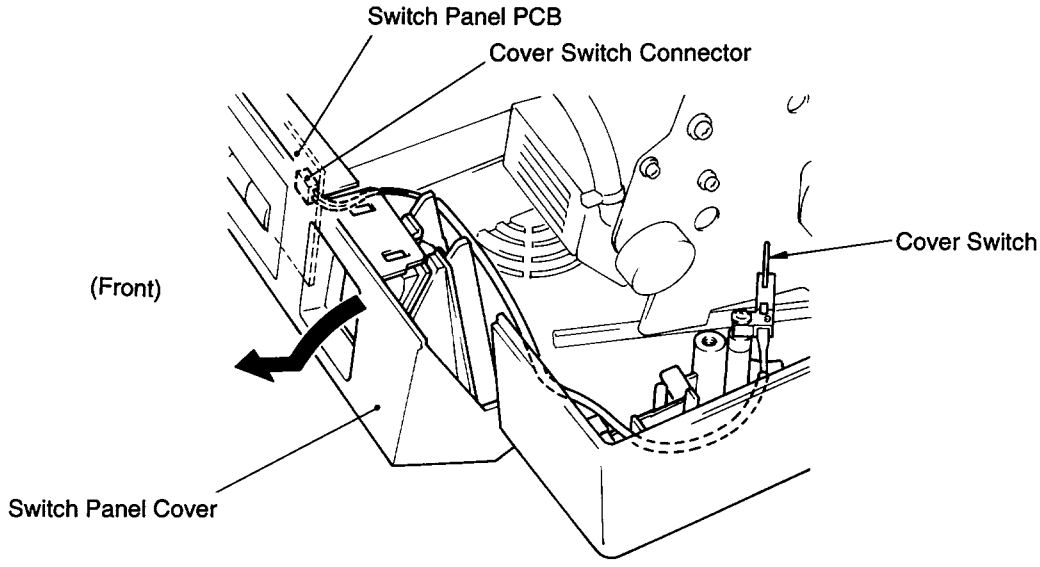


Figure 3.13 Removing the Switch Panel Cover

(5) Disconnect the cover switch connector from the switch panel PCB.

(6) Disconnect the switch panel harness from the main PCB by opening the connector locks. This completes the removal procedure of the switch panel cover.

b. Installation

Reverse the removal procedure.

NOTES • Before installing the switch panel cover, connect the cover switch harness to the switch panel PCB.

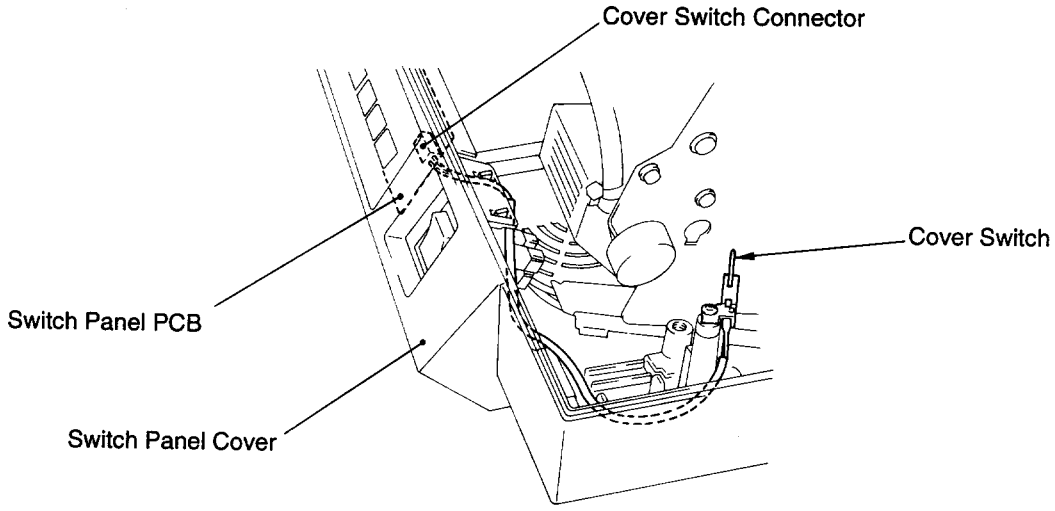


Figure 3.14 Connecting the Cover Switch Harness to the Switch Panel PCB

- Be sure to fit the hooks (d) provided on the bottom end of the switch panel cover over the bottom cover. (See Figure 3.15.)
- While pressing down the switch panel cover, engage the hook (c) over the bottom cover.
- After installation, check that there is no gap at section (X) as shown in Figure 3.15.

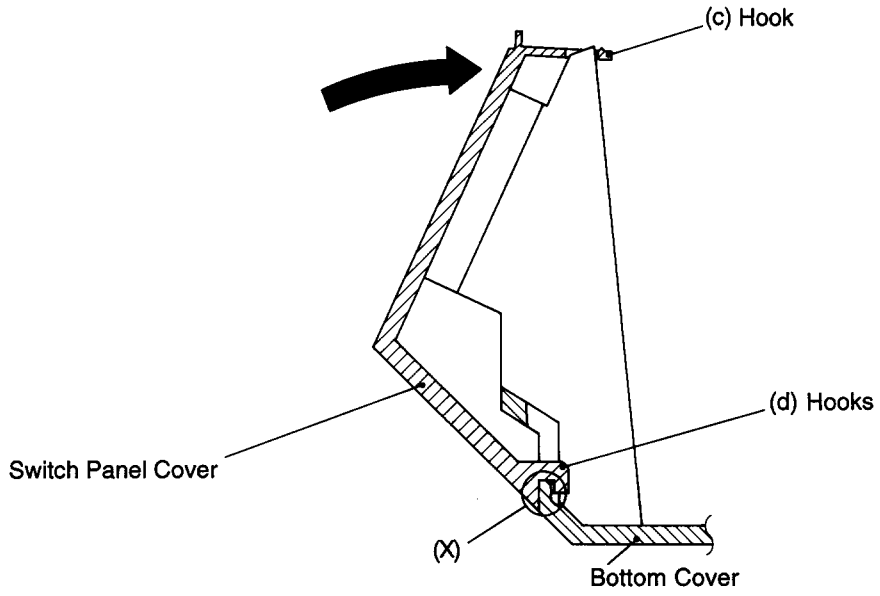


Figure 3.15 Installing the Switch Panel Cover

3.3 Chassis Unit

a. Removal

(1) Remove the switch panel cover. (Refer to Subsection 3.2.2.)

Make sure that the front end of the chassis unit is supported with the platen knob and that the rear end is locked with the rear chassis pressure plates.

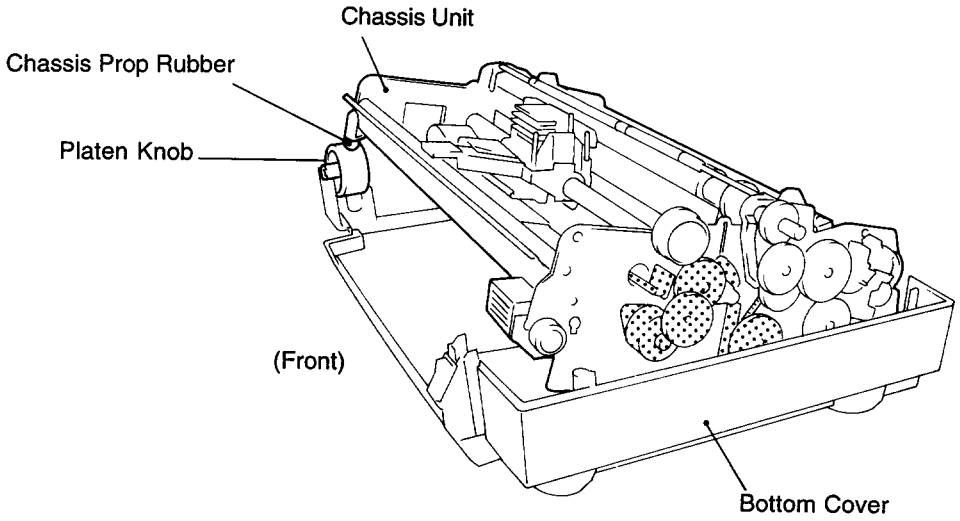


Figure 3.16 Supporting the Front End of Chassis with Platen Knob

(2) Disconnect all of the connectors from the main PCB except for the interface cable connector and DC power supply connector.

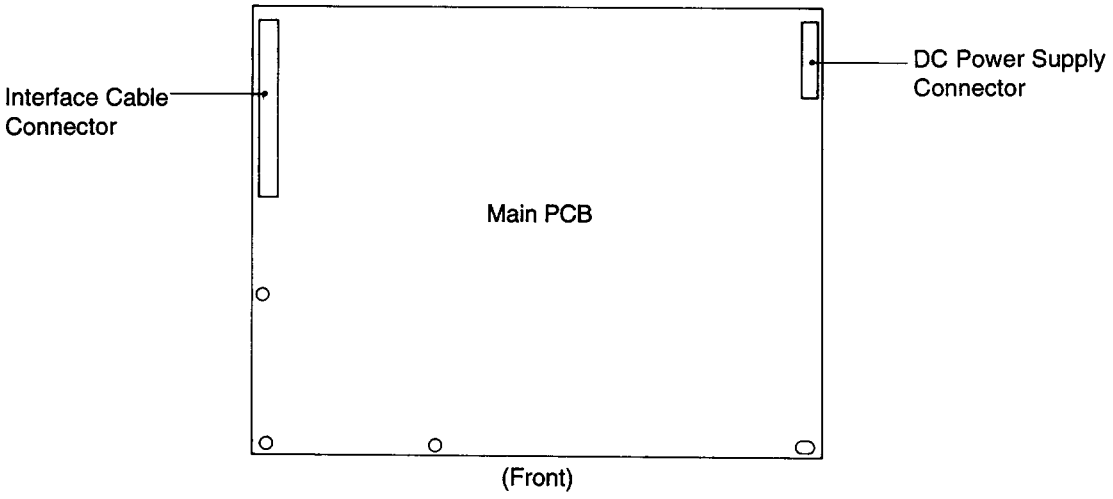


Figure 3.17 For Interface Cable and DC Power Supply Connectors

(3) Remove the platen knob and lower the front end of the chassis unit.

(4) Remove the rear chassis pressure plates. (Refer to Figure 3.10.)

(5) Grasp both ends of the chassis unit as shown in Figure 3.18 and slowly lift it up and out of the bottom cover, taking care not to bump the chassis unit against the cover switch.

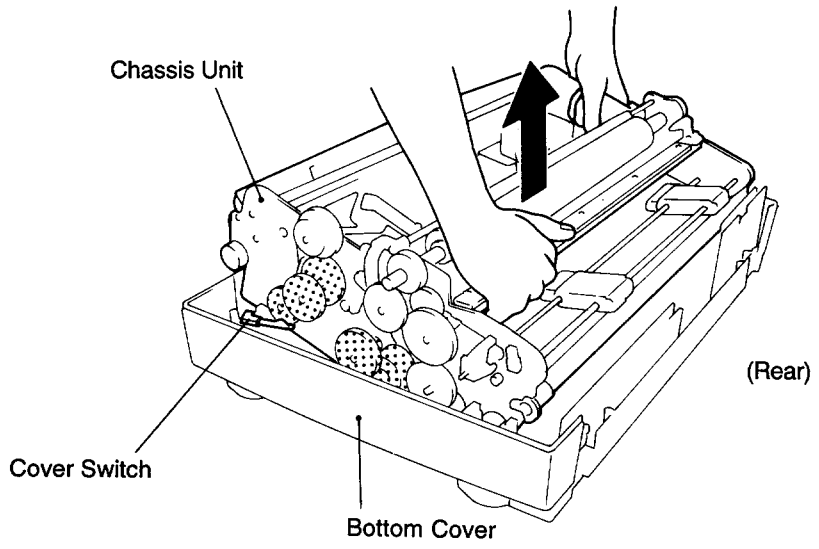


Figure 3.18 Removing the Chassis Unit

b. Installation

(1) Grasp both ends of the chassis unit as shown in Figure 3.18 and place the chassis unit back onto the bottom cover, first setting-in the rear chassis prop rubbers and then the front ones, taking care not to bump the chassis against the cover switch.

(2) Lock the rear end of the chassis unit with the two chassis pressure plates. (Refer to Figure 3.10.)

(3) Raise the front end of the chassis unit and support it with the platen knob. (See Figure 3.16.)

(4) Connect the print head cable and other harness connectors to the main PCB, by checking the number of the connector pins and the connector ID colors. (Refer to Figure 3.22.)

(5) Install the switch panel cover. (Refer to Subsection 3.2.2.)

(6) Remove the platen knob and lower the front end of the chassis unit.

(7) Lock the front end of the chassis unit with the two chassis pressure plates.

(8) Install the body cover, rear cover, and top cover. (Refer to Subsection 3.2.1.)

3.4 PCBs

3.4.1 Main PCB

a. Removal

(1) Remove the switch panel cover. (Refer to Subsection 3.2.2.)

Make sure that the front end of the chassis unit is supported with the platen knob and that the rear end is locked with the rear chassis pressure plates.

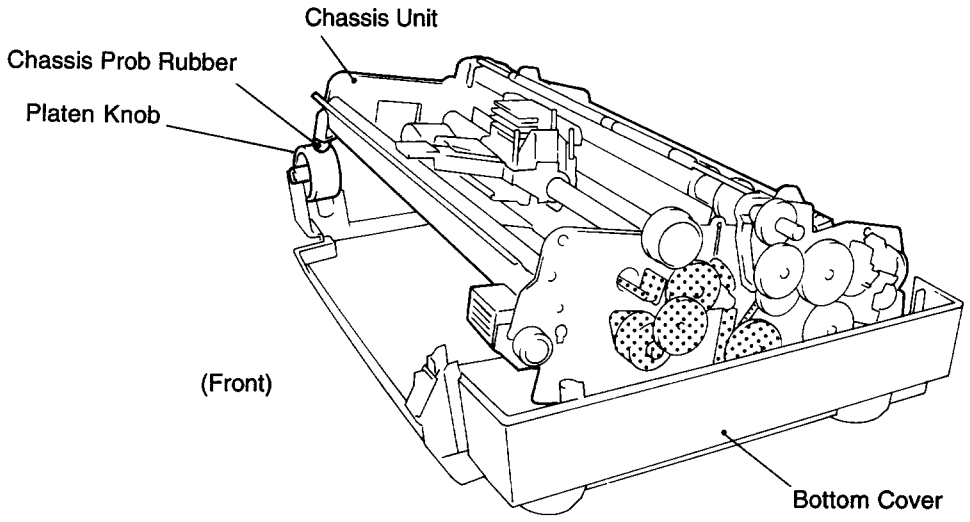


Figure 3.19 Supporting the Front End of Chassis with Platen Knob

(2) Disconnect the print head cable and all of the harness connectors from the main PCB.

(3) Remove the screw (e) from the main PCB.

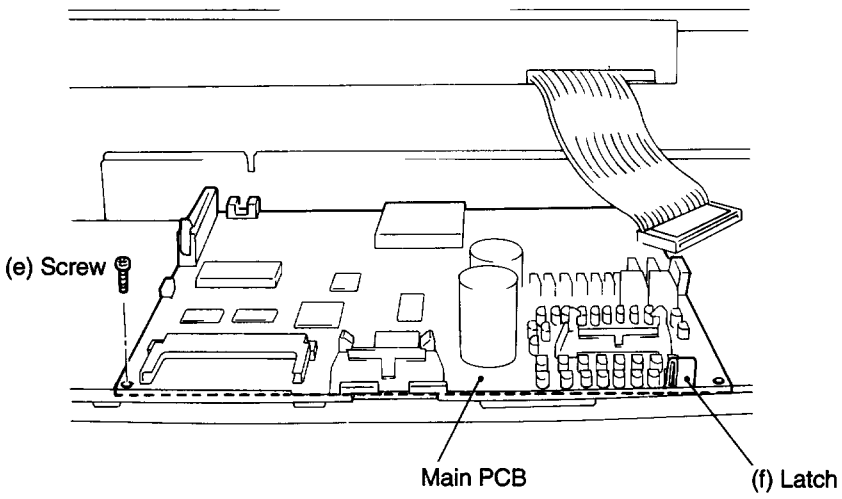


Figure 3.20 Removing the Main PCB

(4) Unhook the latch (f) and take the main PCB up and out of the bottom cover.

b. Installation

(1) If the main PCB is replaced with a new one, remove the EEPROM from the old PCB with an IC pull-out and set it onto the new PCB.

NOTE: When setting the EEPROM, be sure to put it with its concave section facing as illustrated in Figure 3.22.

If both the main PCB and the EEPROM have been replaced with new ones, be sure to take care of adjustment works described in Subsection 4.1.2, [1], [2] (A), and [3] through [7], following step (9) below. (Adjustment [2] (A) is required only for those models equipped with the automatic head-adjust mechanism.)

(2) Fit the rear edge of the main PCB into the hooks (g) along the guides (h), taking care not to bump the PCB against the bottom feed PE actuator.

Check that the bottom feed PE actuator works correctly.

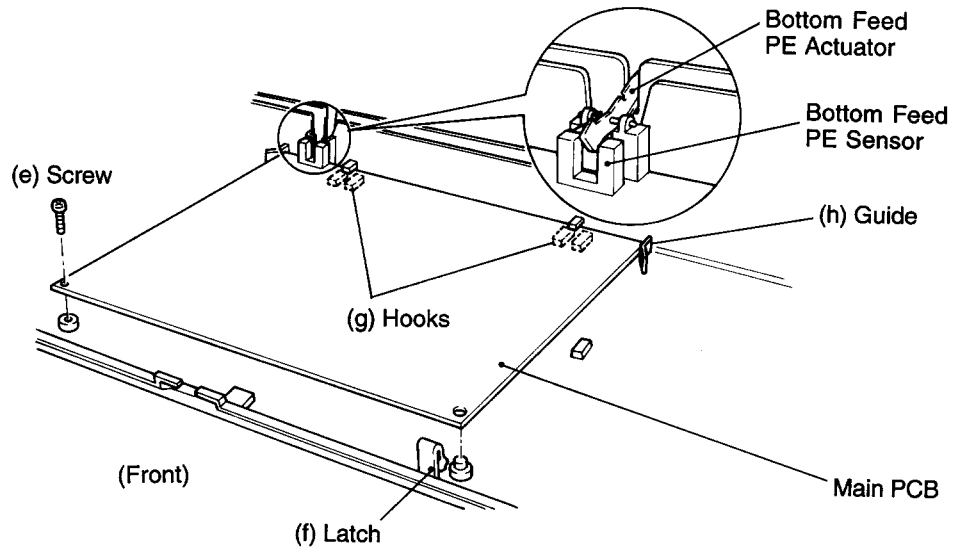


Figure 3.21 Installing the Main PCB

(3) Set the main PCB into the latch (f).

(4) Tighten the screw (e).

(5) Connect the print head cable and other harness connectors to the main PCB, by checking the number of the connector pins and the connector ID colors. (See Figure 3.22.)

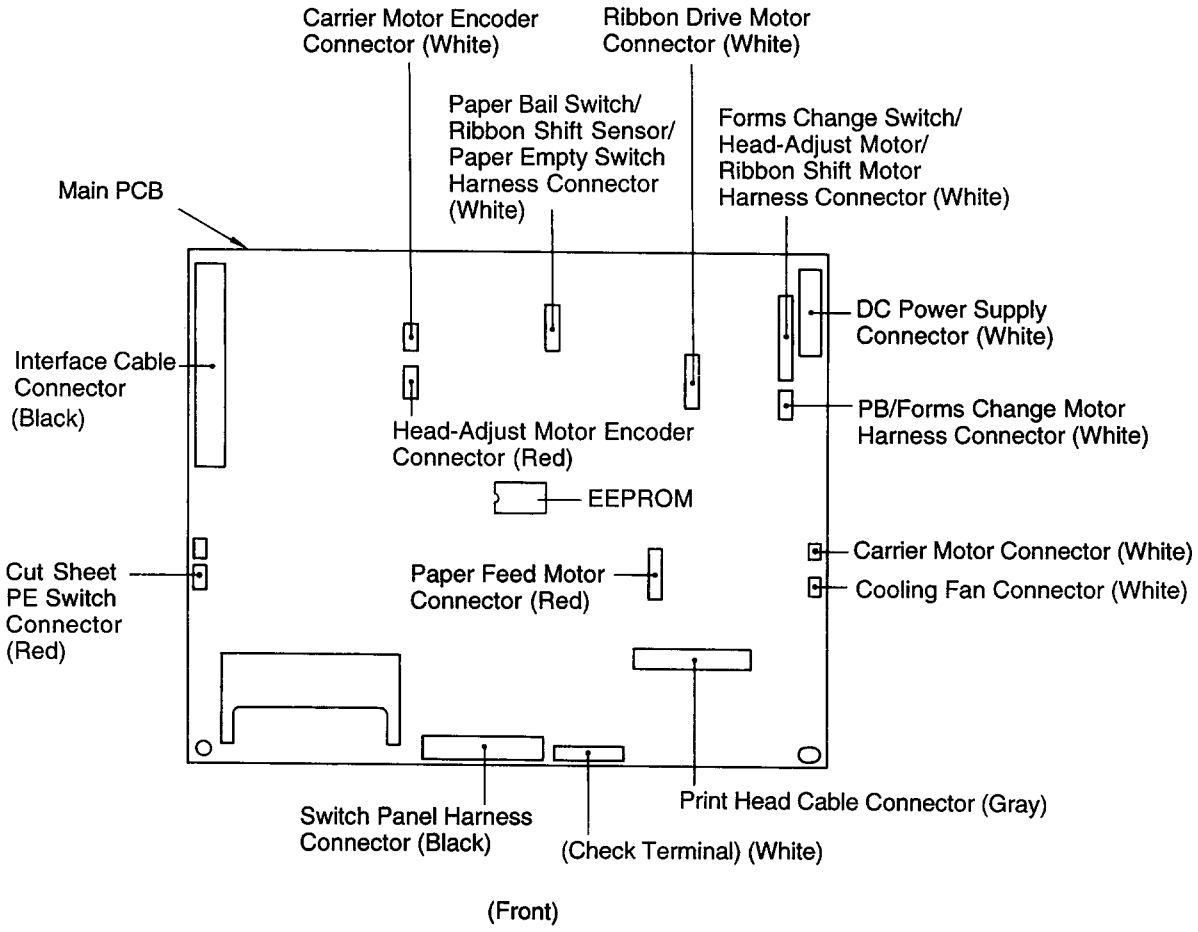

Carrier Motor Encoder Connector (White)
Ribbon Drive Motor Connector (White)
Paper Bail Switch/ Ribbon Shift Sensor/ Paper Empty Switch Harness Connector (White)
Forms Change Switch/ Head-Adjust Motor/ Ribbon Shift Motor Harness Connector (White)
Main PCB
DC Power Supply Connector (White)
Interface Cable Connector (Black)
PB/Forms Change Motor Harness Connector (White)
Head-Adjust Motor Encoder Connector (Red)
EEPROM
Carrier Motor Connector (White)
Cooling Fan Connector (White)
Cut Sheet PE Switch Connector (Red)
Paper Feed Motor Connector (Red)
Print Head Cable Connector (Gray)
Switch Panel Harness Connector (Black)
(Check Terminal) (White)
(Front)

Figure 3.22 Connecting the Head Cable and Harnesses

(6) Make sure that all harnesses are firmly connected, then install the switch panel cover. (Refer to Subsection 3.2.2.)

(7) Remove the platen knob and lower the chassis unit.

(8) Lock the front end of the chassis unit with the two chassis pressure plates.

(9) Install the body cover.

(10) If the EEPROM has been replaced with a new one during the above work, take care of Subsection 4.1.2, [1], [2] (A), and [3] through [7].

3.4.2 Interface PCB

a. Removal

(1) Remove the switch panel cover. (Refer to Subsection 3.2.2.)

Make sure that the front end of the chassis unit is supported with the platen knob and that the rear end is locked with the rear chassis pressure plates. (See Figure 3.19.)

(2) Disconnect the interface cable connector from the main PCB and take out the cable from the shell clip.

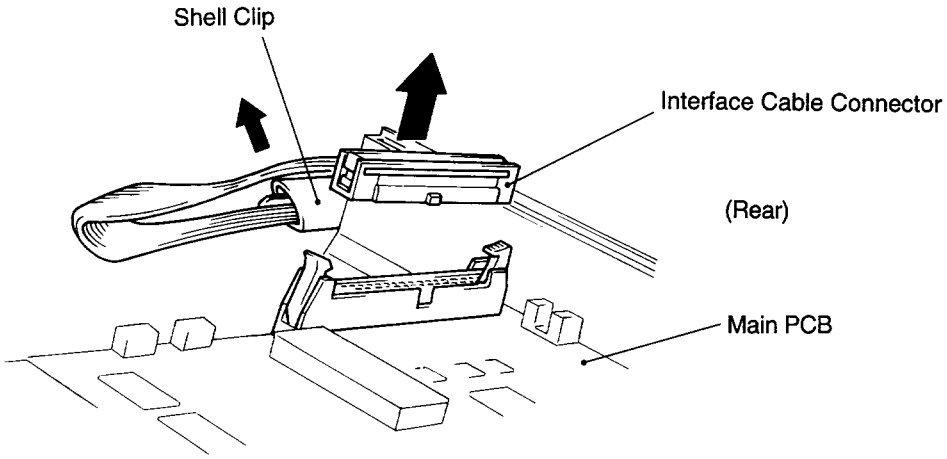


Figure 3.23 Disconnecting the Interface Cable Connector

(3) Remove the platen knob and lower the front end of the chassis unit, taking care not to pinch the disconnected interface cable between the chassis unit and the bottom cover. Lock the front end of the chassis with the two chassis pressure plates.

(4) Remove the two rear chassis pressure plates, raise the rear end of the chassis unit, and support it with the platen knob as illustrated in Figure 3.24

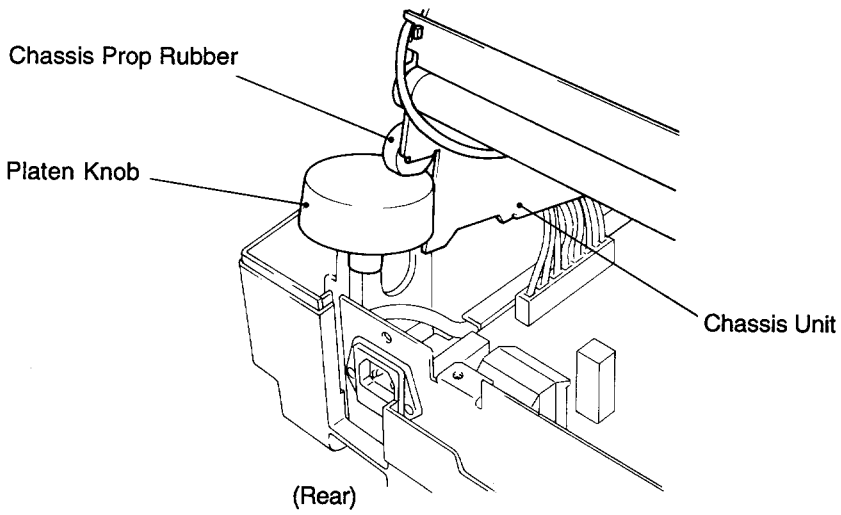


Figure 3.24 Supporting the Rear End of Chassis with Platen Knob

(5) Remove the two screws (h) from the interface PCB.

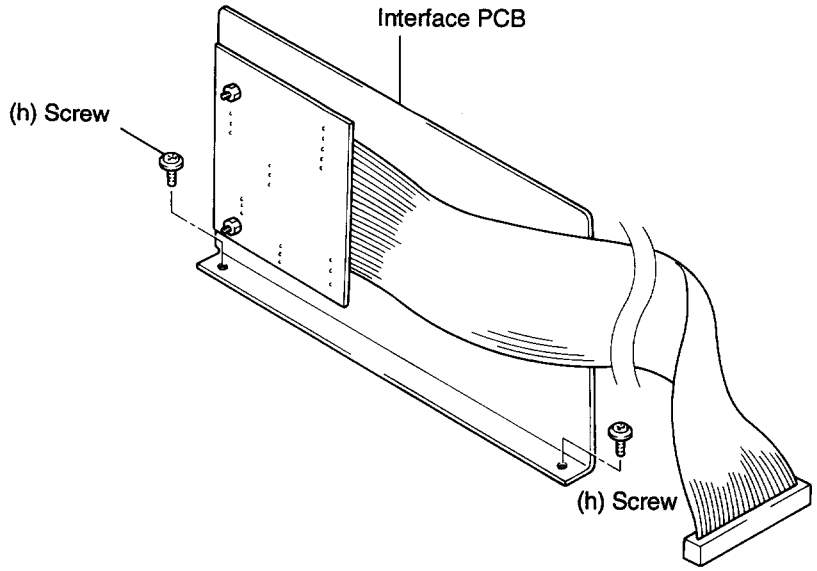


Figure 3.25 Removing the Interface PCB

b. Installation

Reverse the removal procedure.

NOTE: Before raising the front end of the chassis unit, be sure to secure the rear end of the chassis unit with the two chassis pressure plates.

3.4.3 Switch panel PCB

a. Removal

(1) Remove the switch panel cover. (Refer to Subsection 3.2.2.)

Make sure that the front end of the chassis unit is supported with the platen knob and that the rear end is locked with the rear chassis pressure plates. (See Figure 3.19.)

(2) Remove the two screws (i).

(3) Unlatch the four hooks and take the switch panel PCB off the switch panel cover.

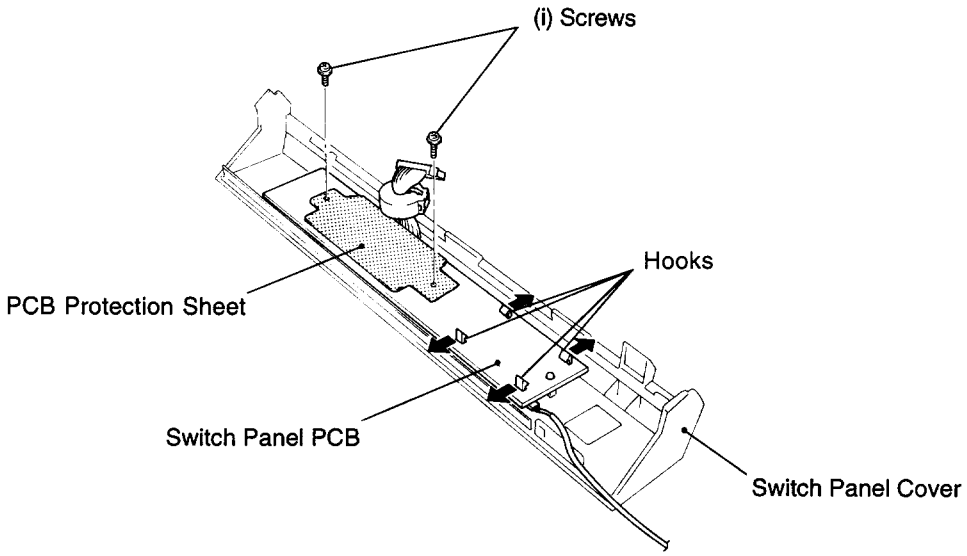


Figure 3.26 Removing the Switch Panel PCB

b. Installation

(1) Set the key switches on the switch panel cover.

(2) Push down the switch panel PCB near the four hooks to latch the PCB into place.

(3) Secure the PCB and its protection sheet with the screws (i), taking care of the installation direction of the protection sheet (see Figure 3.26).

(4) Install the switch panel cover to the bottom cover. (Refer to Subsection 3.2.2.)

(5) Install the body cover. (Refer to Subsection 3.2.1.)

3.5 Print Head Cable ASSY

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Open the ribs provided on the bottom cover and slide the chassis pressure plate outwards. (There is one on each side of the front end of the chassis.)

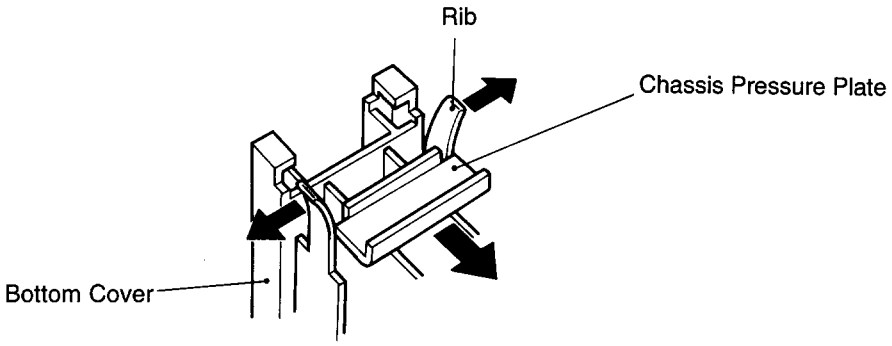


Figure 3.27 Removing the Chassis Pressure Plates

(5) Remove the print head. (Refer to Section 3.1.)

(6) Remove the screw (j) securing the head cable holder.

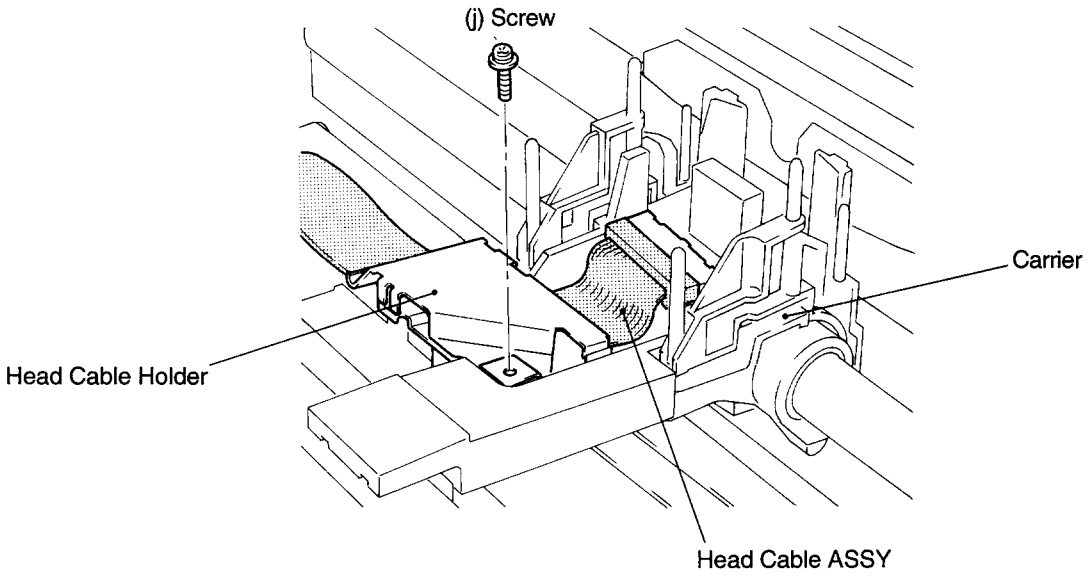


Figure 3.28 Releasing the Head Cable Holder

(7) Remove the screw (k) securing the head cable clamp.

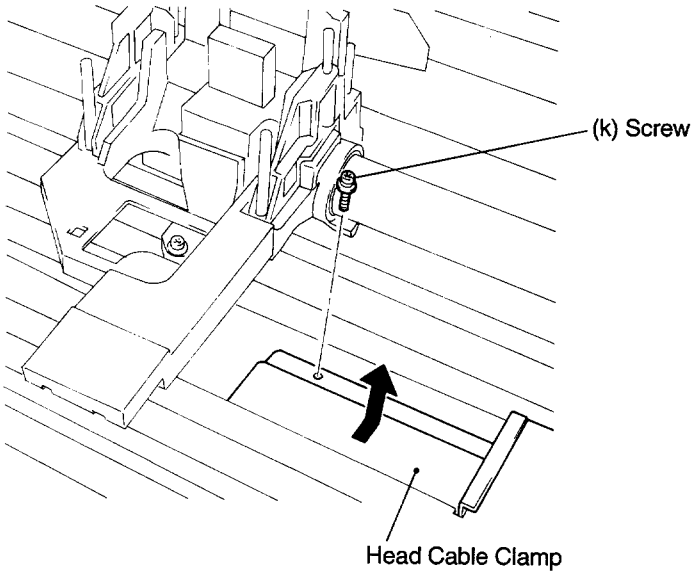


Figure 3.29 Removing the Head Cable Clamp

(8) Remove the switch panel cover. (Refer to Subsection 3.2.2.)

Make sure that the front end of the chassis unit is supported with the platen knob and that the rear end is locked with the rear chassis pressure plates.

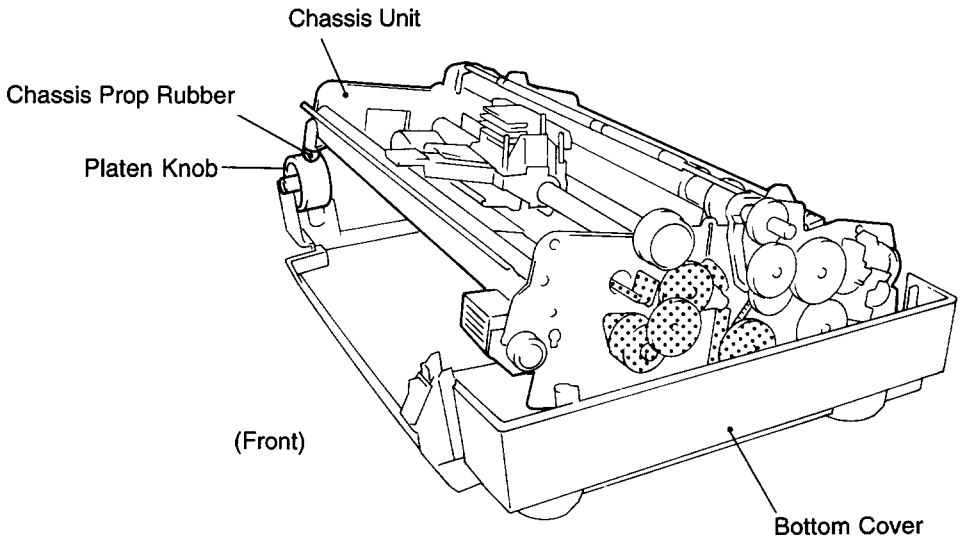


Figure 3.30 Supporting the Front End of Chassis with Platen Knob

(9) Disconnect the head cable connector from the main PCB. (See Figure 3.22.)

(10) Remove the print head cable ASSY which sticks to the print head cable guide with a double-sided adhering soft tape.

b. Installation

(1) Lower the front end of the chassis unit.

(2) Secure the head cable holder to the carrier with the screw (j).

(3) Move the carrier to the left end of its travel.

(4) Arrange the print head cable so that the outside protection film protrudes by 0-15 mm outside the left end of the chassis, then stick the protection film to the head cable guide with soft tape. (See Figure 3.31.)

(5) Secure the head cable clamp with the screw (k) so that each gap between the head cable and its protection films is 1-2 mm and that the head cable is parallel with the print head cable guide.

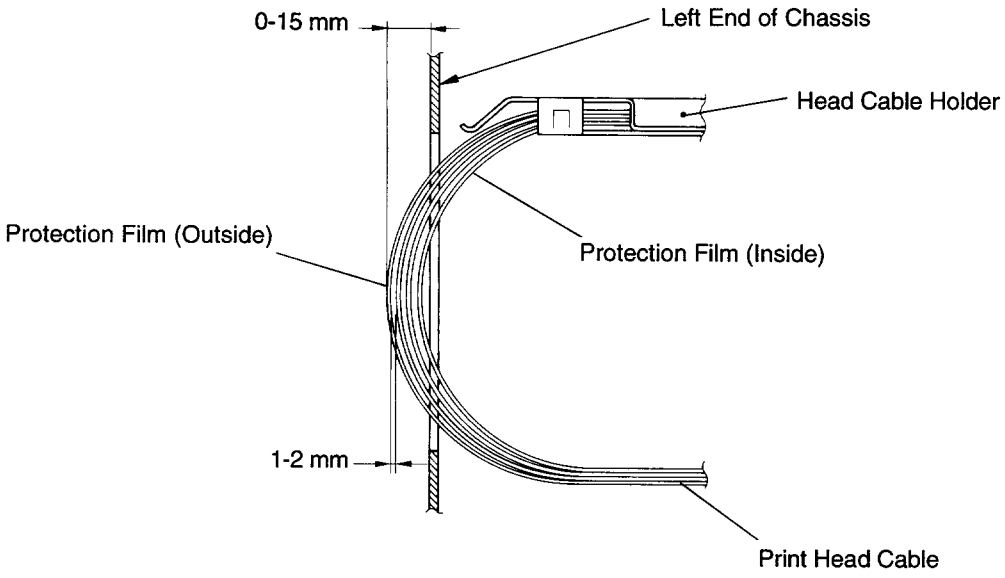


Figure 3.31 Arranging the Print Head Cable

(6) Shift the carrier to the right and left to check that the print head cable moves smoothly and does not come into contact with the chassis.

(7) Raise the front end of the chassis unit and support it with the platen knob.

(8) Connect the head cable connector to the main PCB.

(9) Install the switch panel cover. (Refer to Subsection 3.2.2.)

(10) Lower the front end of the chassis unit and lock it with the chassis pressure plates.

(11) Install the print head. (Refer to Section 3.1.)

(12) Install the body cover, ribbon cassette, and top cover.

3.6 Power Supply Unit

a. Removal

(1) Remove the top cover, rear cover, and body cover. (Refer to Subsection 3.2.1.)

(2) Remove the switch panel cover. (Refer to Subsection 3.2.2.)

Make sure that the front end of the chassis unit is supported with the platen knob and that the rear end is locked with the rear chassis pressure plates. (See Figure 3.19.)

(3) Disconnect all of the connectors from the main PCB except for the interface cable connector. (Refer to Figure 3.22.)

(4) Remove the chassis unit from the bottom cover. (Refer to Section 3.3.)

(5) Remove the two screws (m) securing the power supply unit.

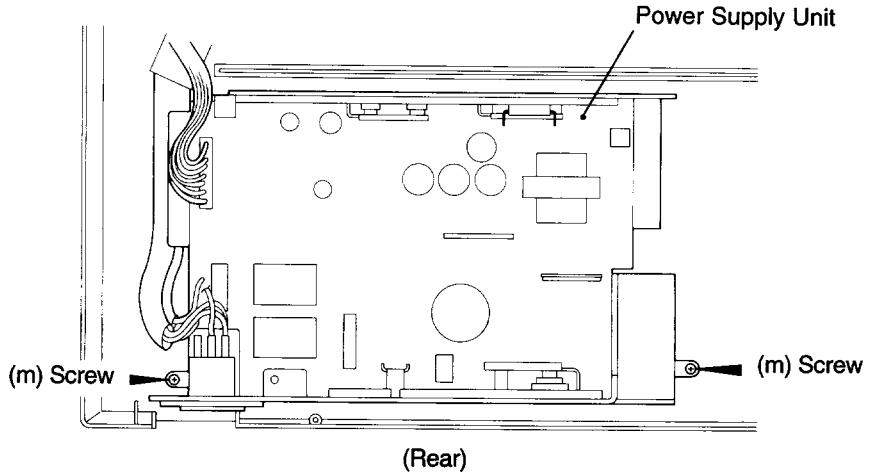


Figure 3.32 Removing the Screws Securing the Power Supply Unit

(6) Remove the screw (n) securing the AC harness cover. (See Figure 3.37.)

(7) Remove the power switch from the bottom cover.

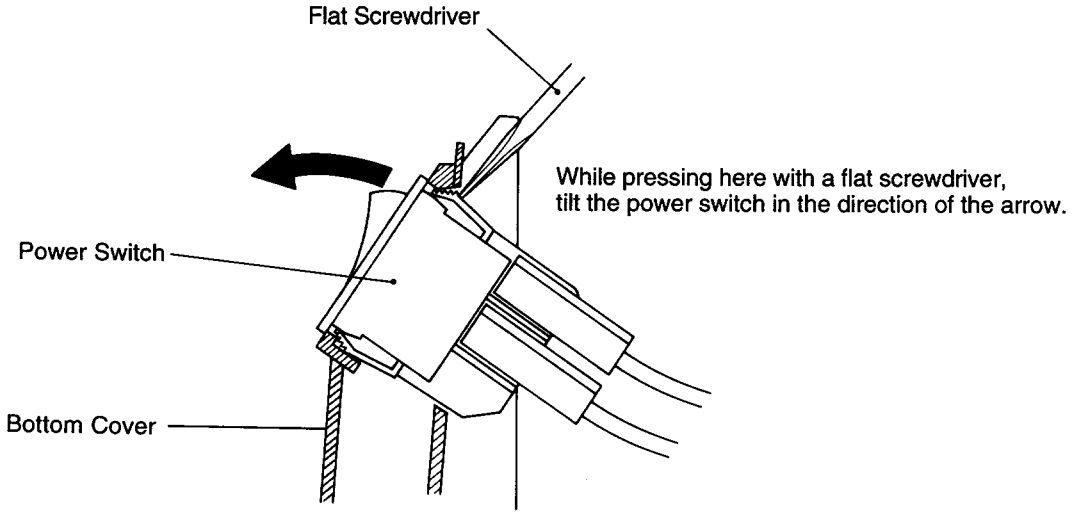

Flat Screwdriver
While pressing here with a flat screwdriver,
tilt the power switch in the direction of the arrow.
Power Switch
Bottom Cover

Figure 3.33 Removing the Power Switch

(8) Take the DC power supply harness out of the shell clip. (See Figure 3.34.)

(9) As shown in Figure 3.34, slide the power supply unit to unlatch it from the hooks provided on the bottom cover, then lift it up and out of the bottom cover.

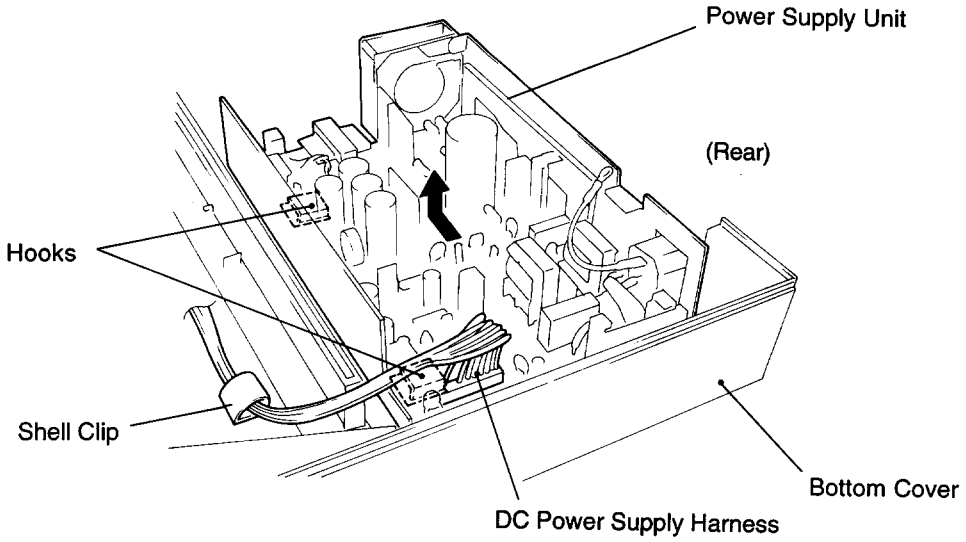


Figure 3.34 Removing the Power Supply Unit

b. Installation

(1) Push the power switch into the bottom cover, with the "|" position facing up.

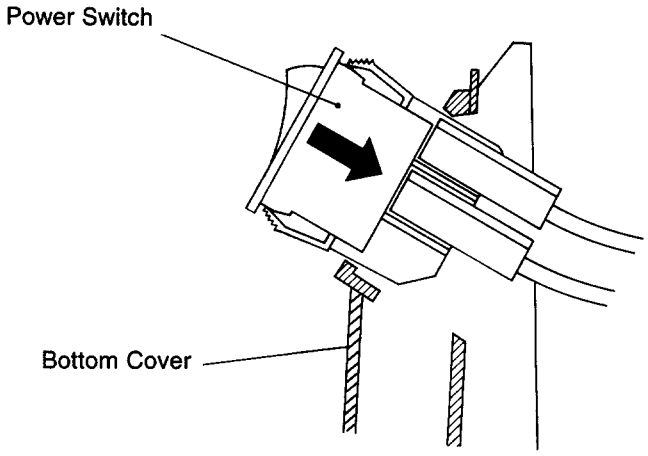


Figure 3.35 Installing the Power Switch

(2) Fit the two square holes provided in the bottom of the power supply unit over the hooks on the bottom cover as shown in Figure 3.36, then slide the power supply unit to the left as viewed from the rear of the printer.

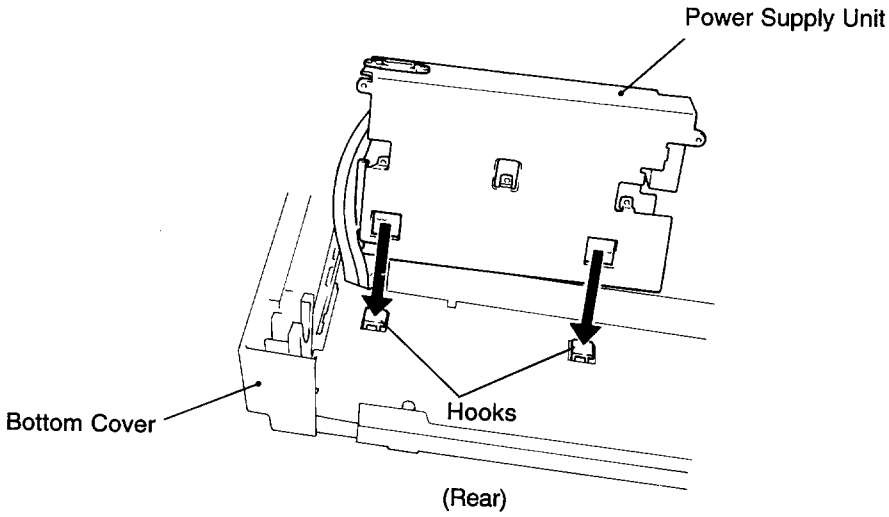


Figure 3.36 Setting the Power Supply Unit onto the Bottom Cover

(3) Fit the two protrusions of the AC harness cover into the holes of the bottom cover and turn the harness cover to cover the AC harness. Then, secure the harness cover with the screw (n).

NOTE: If the AC harness is loose, warp it at the power supply unit side.

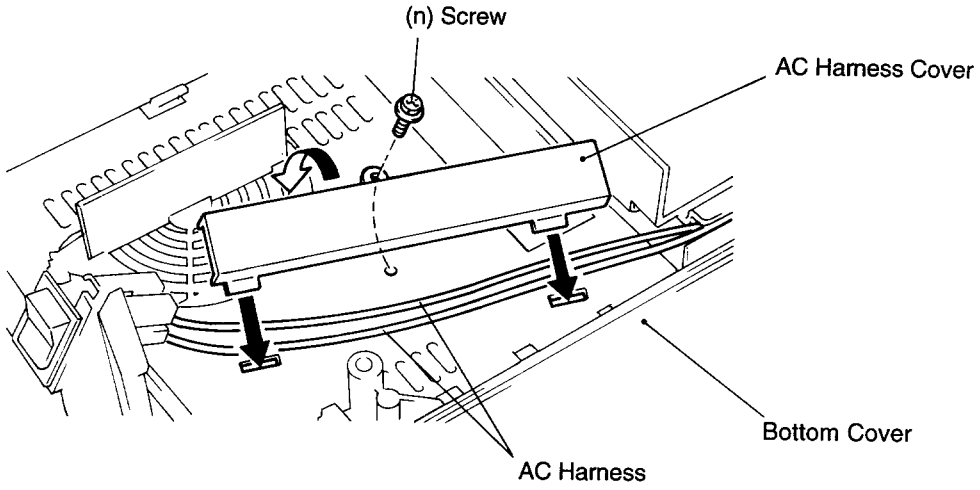


Figure 3.37 Installing the AC Harness Cover

(4) Route the AC harness through the channel between the rib of the bottom cover and the chassis of the power supply unit as shown in Figure 3.38, then secure the power supply unit with the two screws (m). (See Figure 3.32.)

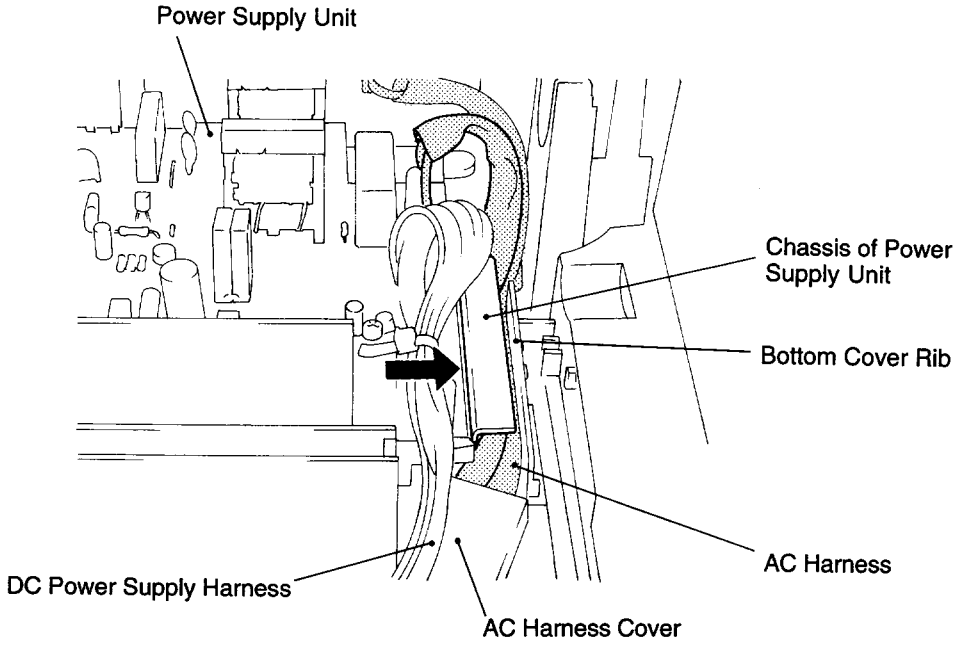


Figure 3.38 Routing the AC Harness

(5) Set the DC power supply harness into the shell clip.

(6) Install the chassis unit to the bottom cover and connect the print head cable and all of the disconnected harnesses to the main PCB. (Refer to Section 3.3 and Figure 3.22.)

(7) Install the switch panel cover. (Refer to Subsection 3.2.2.)

(8) Install the body cover, rear cover, and top cover. (Refer to Subsection 3.2.1.)

3.7 Carrier

The carrier replacement will be required not only when the carrier is broken but also when the carrier bearing wears abnormally. If abnormal wear is noted, check also the main and sub carrier rails carefully and replace them, if necessary, as well as the carrier itself.

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the rear cover and body cover. (Refer to Subsection 3.2.1.)

(4) Remove the print head. (Refer to Section 3.1.)

(5) Remove the print head cable ASSY. (Refer to Section 3.5.)

(6) Remove the screw (o) and take the belt clamp off the carrier timing belt.

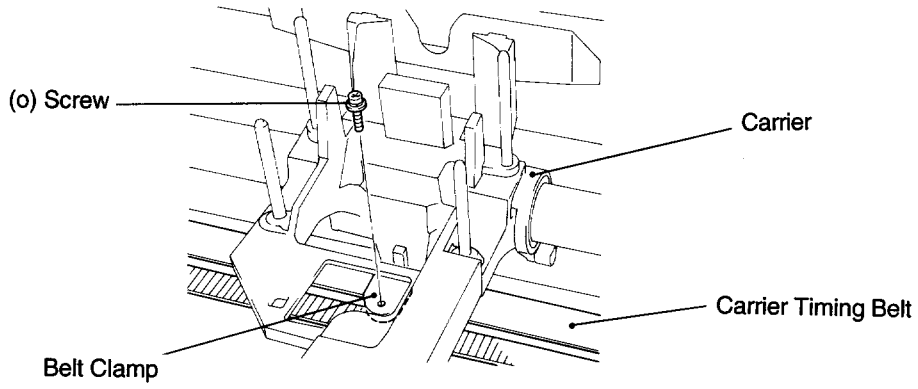


Figure 3.39 Removing the Belt Clamp

(7) Remove the switch panel cover. (Refer to Subsection 3.2.2.)

Make sure that the front end of the chassis unit is supported with the platen knob and that the rear end is locked with the rear chassis pressure plates.

(8) Remove the ribbon drive ASSY. (Refer to Section 3.17.)

(9) • For those models equipped with the automatic head-adjust mechanism:

Remove the head-adjust mechanism (head-adjust motor, head-adjust idle gear, head-adjust gear A, manual head-adjust gear ASSY, head-adjust gear C, and head-adjust slit ASSY). (Refer to Subsection 3.19.1.)

• For those models without the automatic head-adjust mechanism:

Remove the manual head-adjust gear ASSY and the head-adjust gear AB with the detent spring. (Refer to Subsection 3.19.2.)

(10) Remove the two screws (x) securing the head cable guide, and the two screws (t) securing the sub carrier rail to the chassis. (See Figure 3.52.)

(11) While pushing down the head cable guide and pressing the chassis L outwards, pull out the sub carrier rail to the front of the printer, as shown in Figure 3.53.

(12) Remove the snap ring (p) from the main carrier rail at the chassis R.

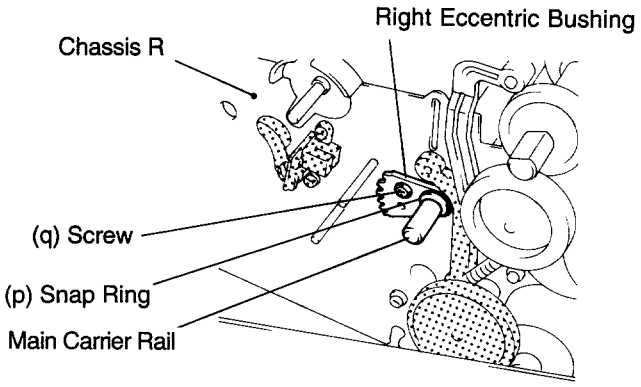


Figure 3.40 Releasing the Main Carrier Rail

(13) Remove the screw (q) from the right eccentric bushing. (See Figures 3.40 and 3.41.)

(14) Move the main carrier rail to the right and take off the right eccentric bushing.

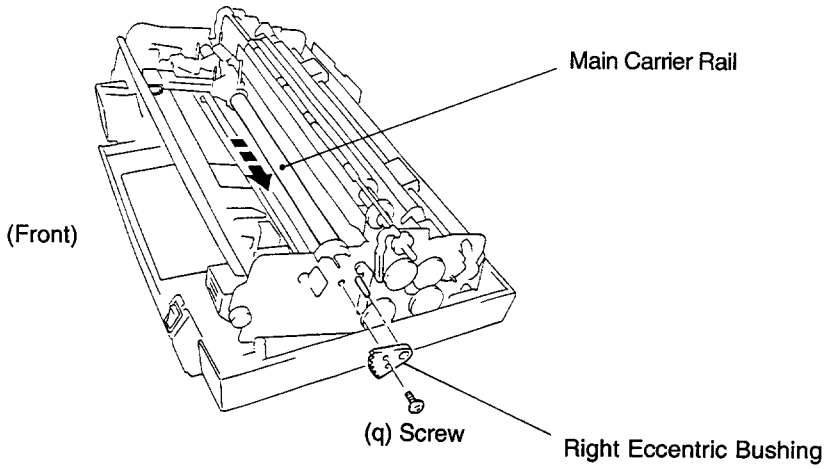


Figure 3.41 Removing the Right Eccentric Bushing

(15) Move the carrier to the left end of the main carrier rail, then pull the main carrier rail to the rightmost position to take it off the left eccentric bushing. (See Figure 3.42.)

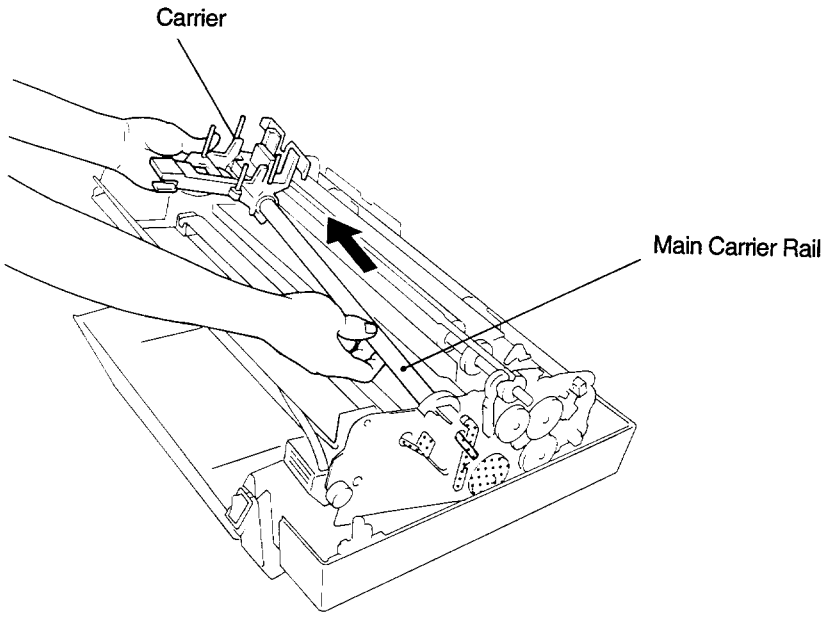


Figure 3.42 Moving the Carrier to the Left

(16) Lift up the main carrier rail together with the carrier.

(17) Pull out the carrier from the main carrier rail.

b. Installation

(1) Place the carrier upside down.

(2) Put the oil pad into the carrier and apply Floil 946P (2.8 cc) uniformly to it.

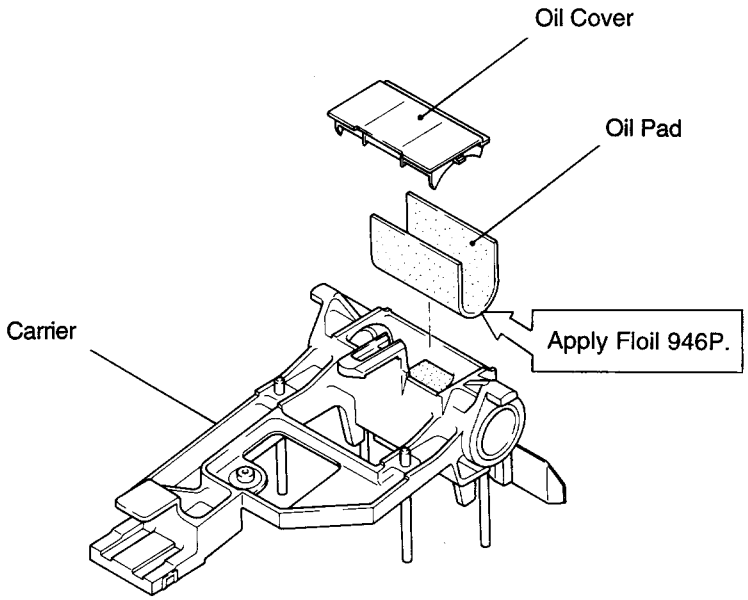


Figure 3.43 Applying Floil 946P to Oil Pad

(3) Set the oil cover to the carrier.

(4) Make sure that the front end of the chassis unit is supported with the platen knob and that the rear end is locked with the rear chassis pressure plates.

(5) Set the carrier onto the main carrier rail, then install the right end of the main carrier rail to the chassis R. (See Figure 3.44.)

(6) Install the left end of the main carrier rail to the left eccentric bushing and chassis L.

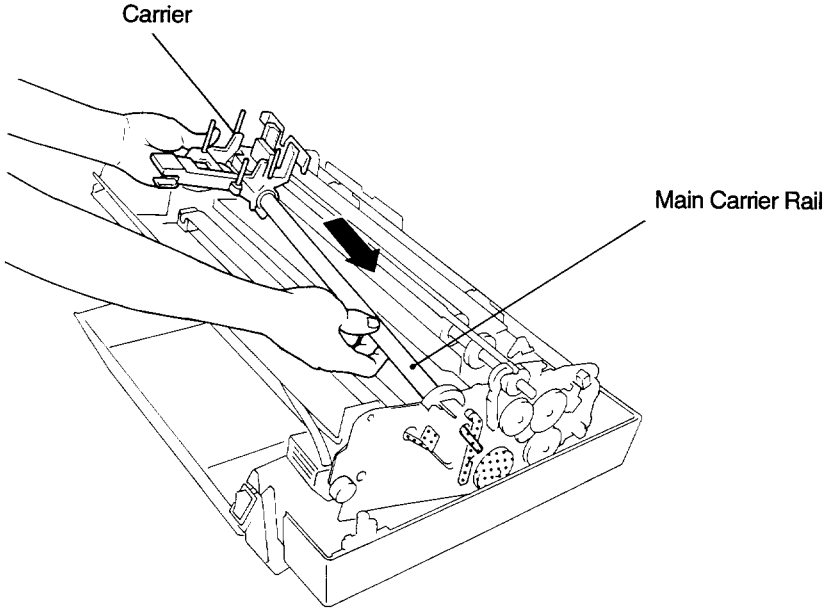


Figure 3.44 Installing the Main Carrier Rail with the Carrier

(7) Fitting the carrier sleeve into the carrier, set the sub carrier rail into the chassis with the widely tapered side facing towards the front of the printer. (See Figures 3.54 and 3.55.) Then, temporarily tighten the two screws (t). (See Figure 3.52.)

(8) Secure the print head cable guide with the screws (x). (See Figure 3.52.)

(9) Secure the right eccentric bushing with the screw (q) so that the notch of the eccentric bushing is aligned with the mark on the chassis R, then set the snap ring (p).

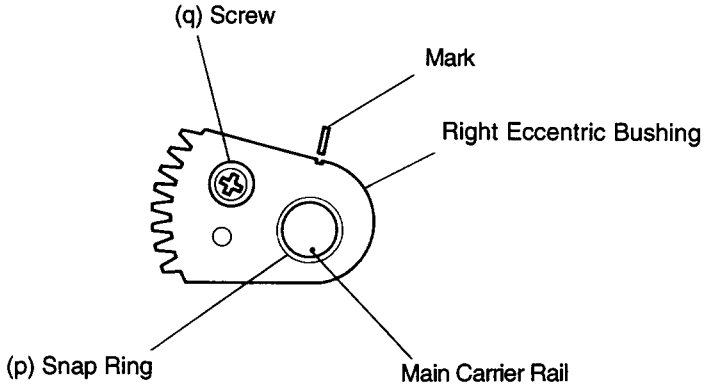


Figure 3.45 Installing the Right Eccentric Bushing

(10) • For those models equipped with the automatic head-adjust mechanism:

Install the head-adjust mechanism (head-adjust slit ASSY, head-adjust gear C, manual head-adjust gear ASSY, head-adjust gear A, head-adjust idle gear, and head-adjust motor). (Refer to Subsection 3.19.1.)

• For those models without the automatic head-adjust mechanism:

Install the head-adjust gear AB with the detent spring and the manual head-adjust gear ASSY. (Refer to Subsection 3.19.2.)

(11) Put Permawick onto the carrier and set the oil cover B.

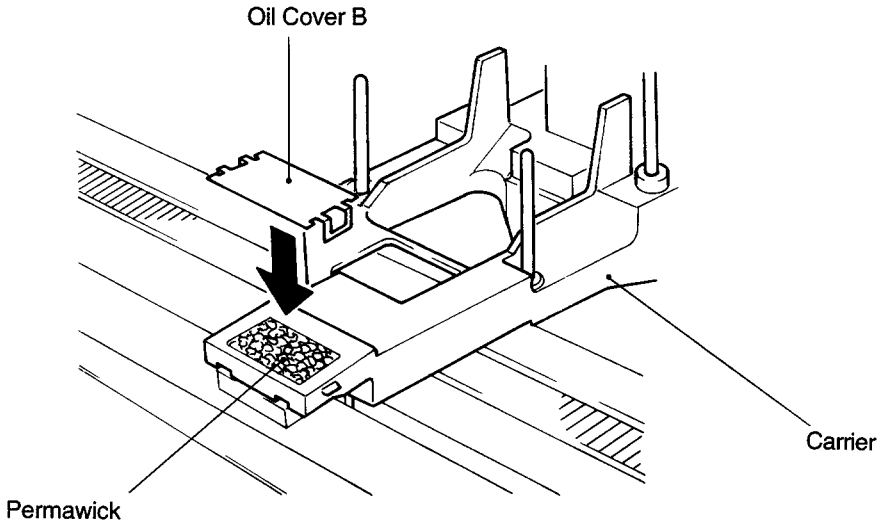


Figure 3.46 Putting Permawick

(12) Secure the carrier timing belt to the carrier with the belt clamp and screw (o). (See Figure 3.39.)

(13) Install the print head cable ASSY.

(14) Install the print head.

(15) Install the ribbon drive ASSY. (Refer to Section 3.17.)

(16) Remove the platen knob, lower the chassis unit, and lock the chassis unit with the chassis pressure plates.

(17) Move the carrier to approx. 10 mm from the right end of the platen by hand.

(18) Turn the manual head-adjust gear to align position "1" with the pointer of the head-adjust scale, as illustrated in Figure 3.47.

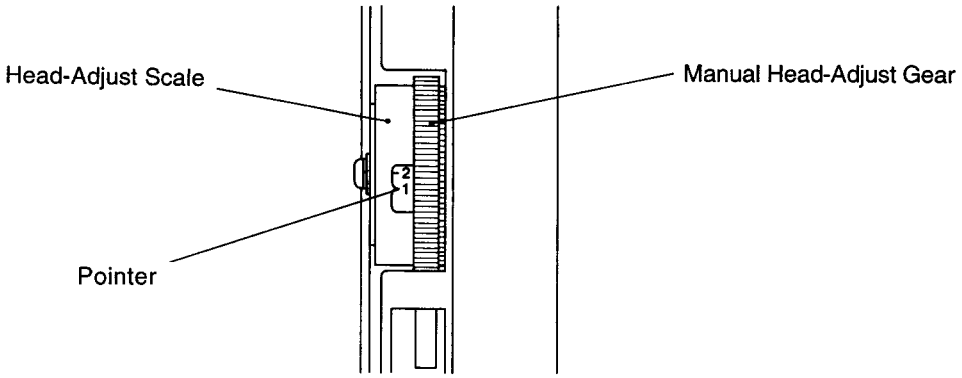


Figure 3.47 Turning the Manual Head-adjust Gear to "1" Position

(19) Adjust the head-platen gap by inserting a pointed tool into the hole in the sub carrier rail and turning the sub carrier rail so that the gap is 0.37 mm. For the gap measurement, use a ø0.37 mm wire gauge.

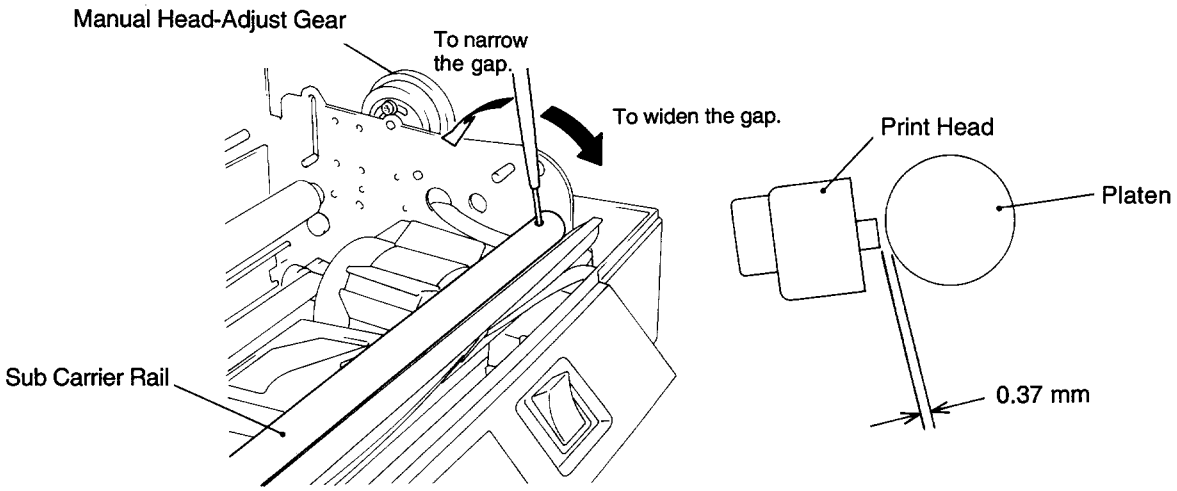


Figure 3.48 Adjusting the Sub Carrier Rail

(20) Firmly tighten the two screws securing the sub carrier rail.

(21) Move the carrier to approx. 10 mm from the left end of the platen by hand.

(22) • For those models equipped with the automatic head-adjust mechanism:

Slightly turn the manual head-adjust gear so that the gap between the print head and the platen is 0.37 mm (use a wire gauge). Then, check that the pointer of the head-adjust scale indicates a point within the 0.35-0.39 mm range marked with the two dots as illustrated in Figure 3.49 (A).

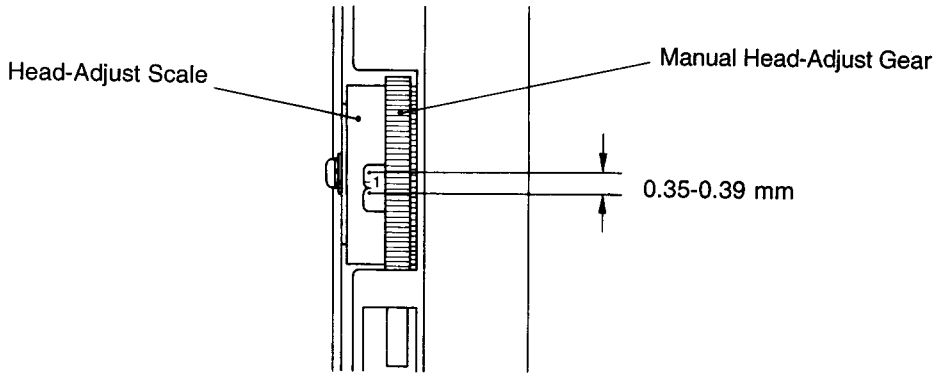


Figure 3.49 (A) 0.35-0.39 mm Range Marked with Two Dots

• For those models without the automatic head-adjust mechanism:

Turn the manual head-adjust gear to align position "1.5" with the pointer of the head-adjust scale and check that the 0.37 mm wire gauge can pass through the head-platen gap. Next, turn the manual head-adjust gear to align position "0.5" with the pointer and check that the gauge cannot pass through the gap.

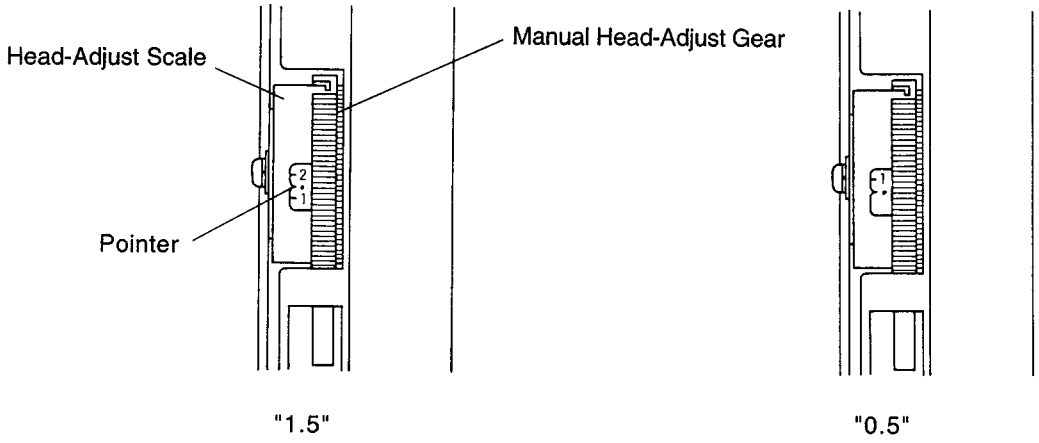


Figure 3.49 (B) Positions "1.5" and "0.5" on the Head-adjust Scale

(23) • For those models equipped with the automatic head-adjust mechanism:

If the pointer indicates out of the specified range, loosen the screw (r), adjust the left eccentric bushing, and tighten the screw (r), as shown in Figure 3.50. Then, go back to step (21).

• For those models without the automatic head-adjust mechanism:

If the gauge cannot pass through the head-platen gap with the pointer indicating "1.5" or if it passes through the gap with the pointer indicating "0.5", loosen the screw (r), adjust the left eccentric bushing, and tighten the screw (r), as shown in Figure 3.50. Then, go back to step (21).

If the left eccentric bushing is rotated in the direction of (a):

If the left eccentric bushing is rotated in the direction of (b):

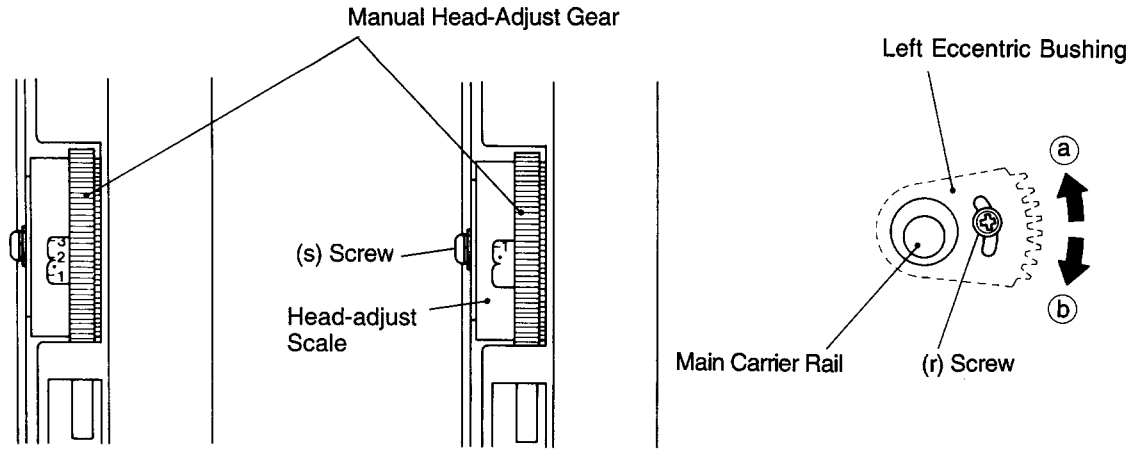


Figure 3.50 Adjusting the Left Eccentric Bushing

(24) Loosen the screw (s) and turn the head-adjust scale to make the pointer indicate the "1" position. Tighten the screw (s).

(25) Install the body cover and the rear cover.

(26) Make the head-platen gap adjustment by referring to Subsection 4.1.2, [2], (A).

NOTE: In the service mode as well, the cover switch works to detect a cover-open error. Therefore, insert a flat screwdriver or the like as shown below to make the cover switch inoperative

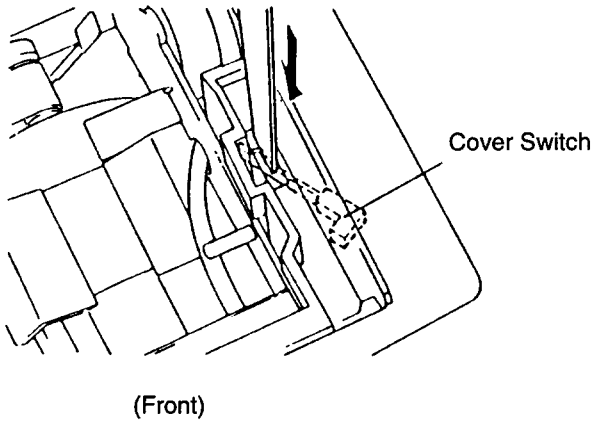


Figure 3.51 Making the Cover Switch Inoperative

(27) Set the ribbon cassette and the top cover.

3.8 Carrier Sleeve

The carrier sleeve should be replaced if abnormal wear is noted. In such a case, check also the sub carrier rail carefully and replace it if necessary.

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the print head. (Refer to Section 3.1.)

(5) Remove the ribbon drive ASSY. (Refer to Section 3.17.)

(6) Remove the two screws (x) securing the head cable guide, and the two screws (t) securing the sub carrier rail to the chassis.

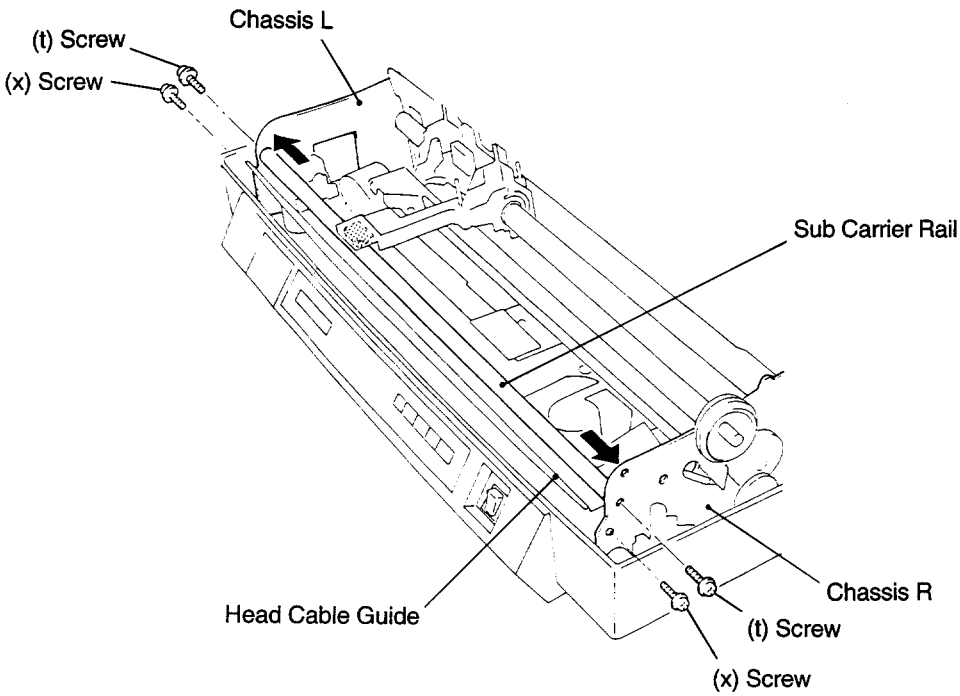


Figure 3.52 Removing Screws Securing the Head Cable Guide and Sub Carrier Rail

(7) While pushing down the head cable guide and pressing the chassis L outwards, pull out the sub carrier rail to the front of the printer, as illustrated in Figure 3.53.

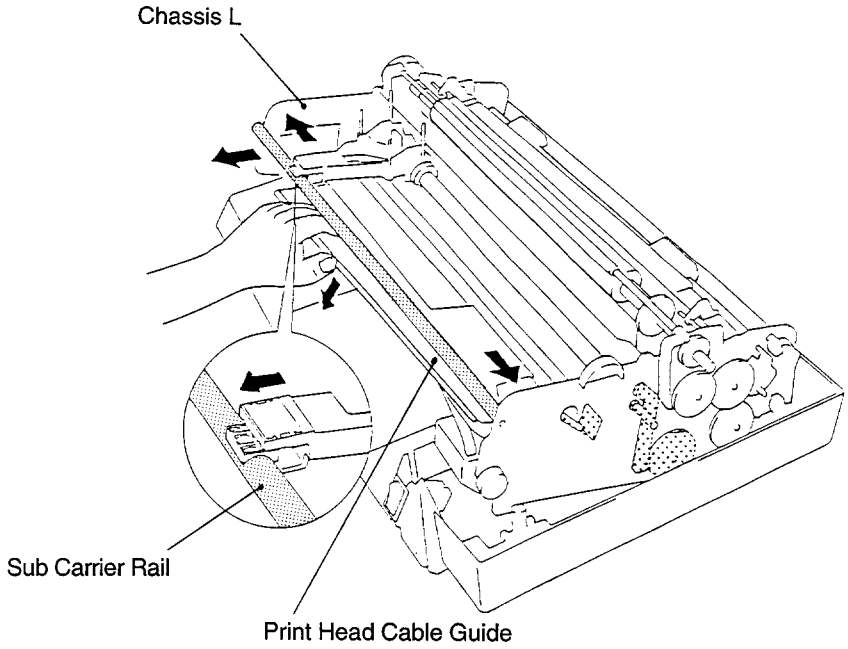


Figure 3.53 Pulling out the Sub Carrier Rail

(8) Remove the carrier sleeve from the sub carrier rail.

b. Installation

(1) Set the carrier sleeve onto the sub carrier rail.

(2) Fitting the carrier sleeve into the carrier, set the sub carrier rail into the chassis with the widely tapered side facing towards the front of the printer. (See Figures 3.54 and 3.55.) Then, temporarily tighten the two screws (t). (See Figure 3.52.)

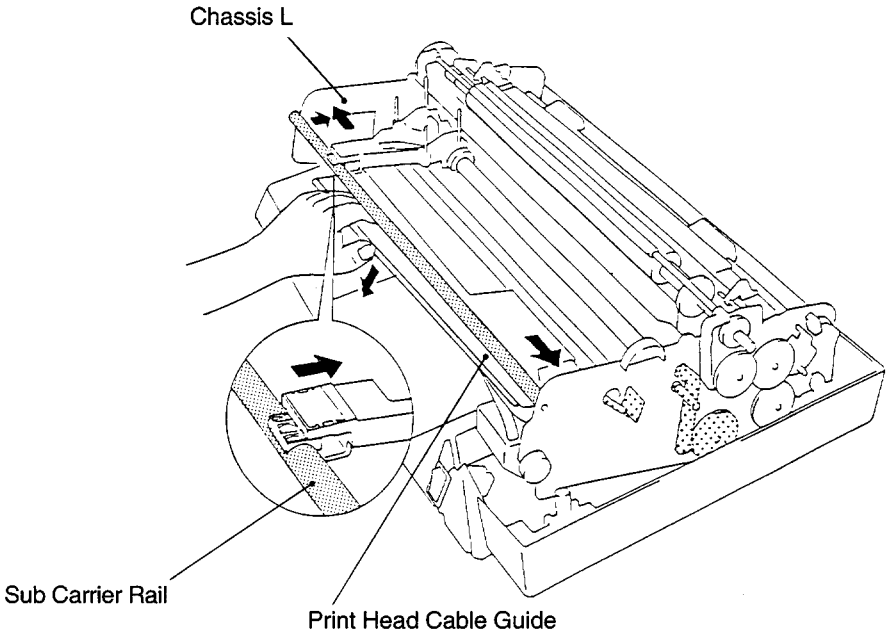


Figure 3.54 Setting the Sub Carrier Rail

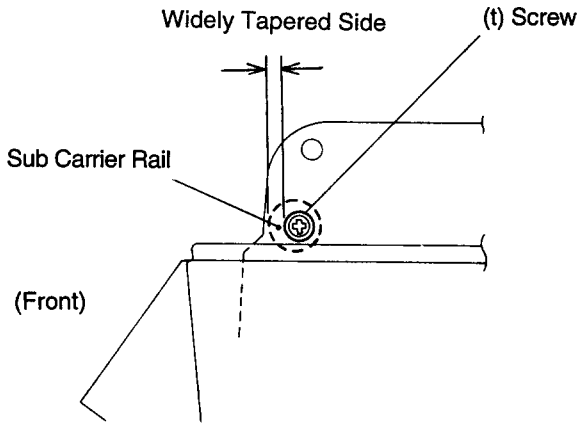


Figure 3.55 Securing the Sub Carrier Rail

(3) Secure the head cable guide with the screws (x). (See Figure 3.52.)

(4) Install the ribbon drive ASSY. (Refer to Section 3.17.)

(5) Move the carrier to approx. 10 mm from the left end of the platen by hand.

(6) Turn the manual head-adjust gear to align position "1" with the pointer of the head-adjust scale. Then, adjust the head-platen gap to 0.37 mm by inserting a pointed tool into the hole in the sub carrier rail and turning the sub carrier rail. For the gap measurement, use a ø0.37 mm wire gauge. (See Figure 3.48.)

(7) Firmly tighten the two screws (t).

(8) After reassembly, apply turbine oil #90 (Nisseki, FBK-32) to the carrier sleeve and its around.

(9) Install the top cover.

(10) Make the head-platen gap adjustment by referring to Subsection 4.1.2, [2], (A).

3.9 Platen

** Clean the platen before trying to replace it with a new one! **

Over extended periods of use, paper fragments and other foreign matter can accumulate on the platen, lowering its resistance coefficient and its ability to advance forms. In such a case, clean the platen surface with ethyl alcohol before trying to replace it. Cleaning the platen has an enough effect on the frictional force.

a. Removal

(1) Make the head-platen gap compensation, by referring to Subsection 4.2.1, [2], (B). (Required only for those models equipped with the automatic head-adjust mechanism.)

(2) Remove the top cover. (Refer to Subsection 3.2.1.)

(3) Pull up the ribbon guide and remove the ribbon cassette.

(4) Remove the two screws (u), then take off the ACF pressure plate and shoulder shaft at each side of the platen.

NOTE: Be sure to remove the shoulder shafts prior to the platen removal. Otherwise, the paper pan may be deformed.

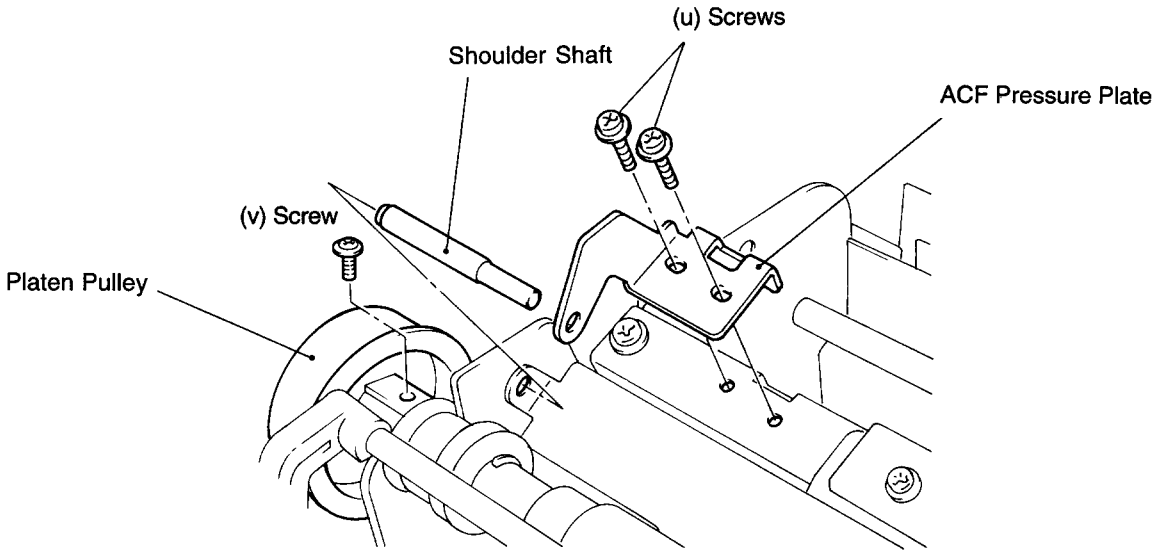


Figure 3.56 Removing the ACF Pressure Plates, Shoulder Shafts, and Platen Pulley

(5) Loosen the screw securing the tension pulley holder and remove the paper feed timing belt. (See Figure 3.85.)

(6) Remove the screw (v) and take off the platen pulley as shown in Figure 3.56.

(7) Remove the snap ring (w) and take the paper bail drive cam R off the chassis R as shown in Figure 3.57.

(8) Remove the snap ring C46, platen gear, spring, and washer from the right end of the platen shaft.

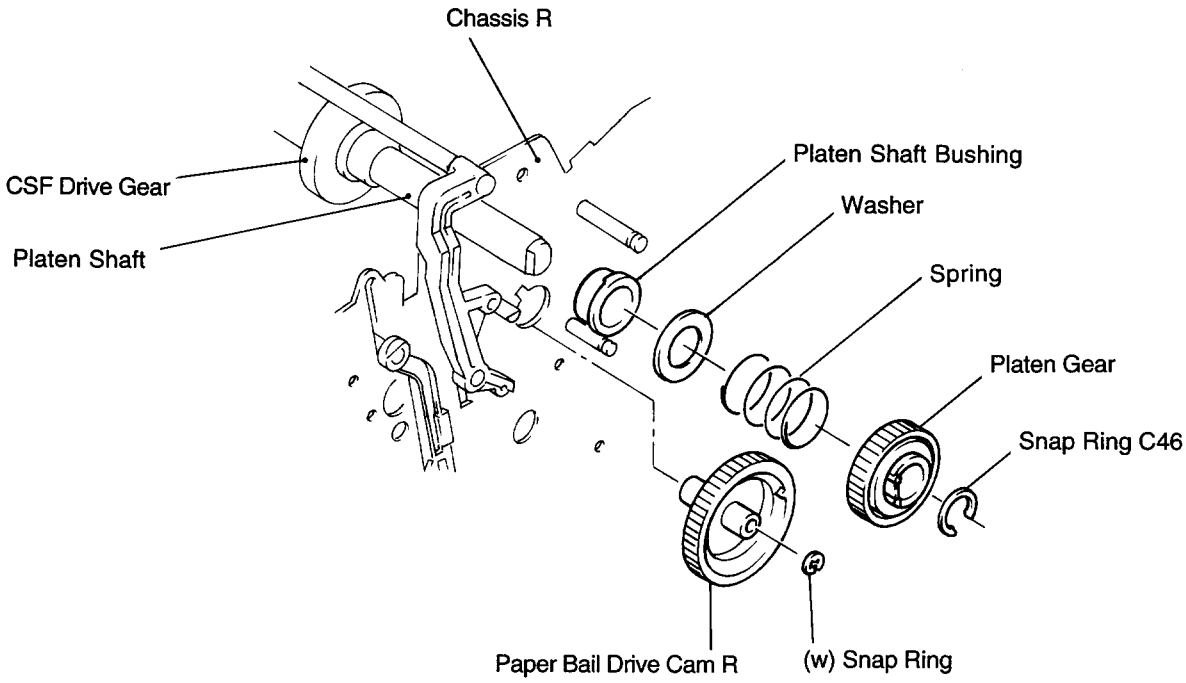


Figure 3.57 Removing the Paper Bail Drive Cam R and Platen Gear

(9) Slide the right and left platen shaft bushings outwards, then lift the platen up and off the chassis.

b. Installation

Reverse the removal procedure.

NOTES
- When installing the paper bail drive cam R, align the marking on it with that on the forms change gear. (Refer to Figure 3.78.)
- When installing the paper feed timing belt, adjust its tension. (Refer to Section 3.16.)
- When installing the shoulder shafts and ACF pressure plates, use the paper pan positioning jig as illustrated in Figure 3.58.

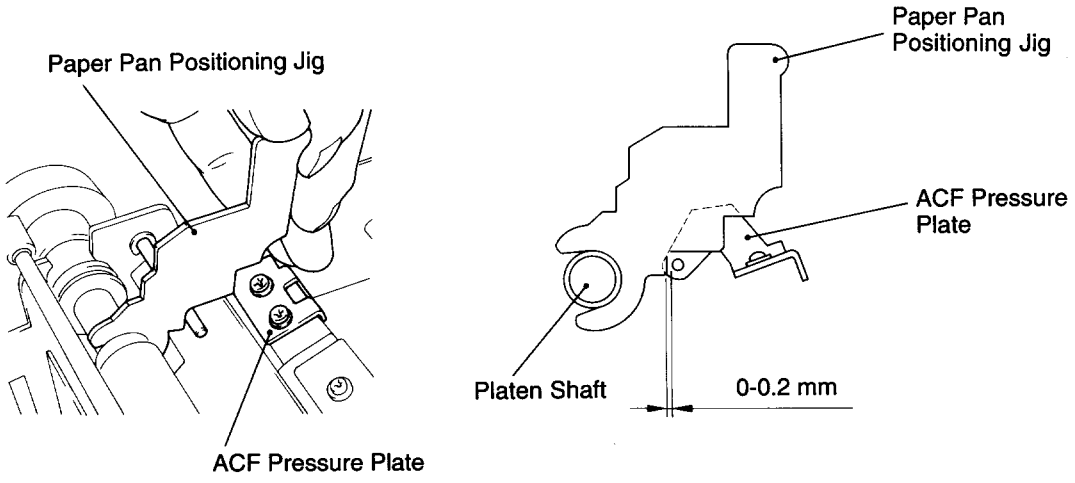


Figure 3.58 Adjusting the Shoulder Shafts and ACF Pressure Plates

- Check that the gap between the paper pan and the platen is 0.30-0.37 mm, by using a wire gauge. If the gap is not correct, adjust the paper pan by shifting the two adjust plates in the direction of the arrow shown in Figure 3.59.

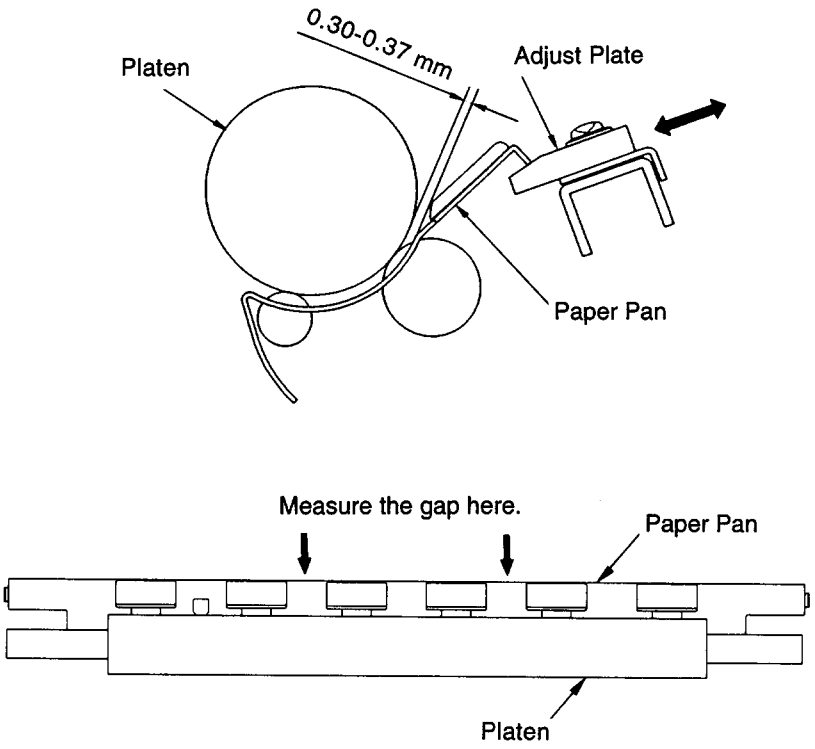


Figure 3.59 Adjusting the Paper Pan

- If the platen or the platen shaft bushings are replaced with new ones, apply a small amount of turbine oil #90 (Nisseki FBK-32) to the bushings.
- After reassembly, make the platen property compensation by referring to Subsection 4.1.2, [2], (C). (Required only for those models equipped with the automatic head-adjust mechanism.)

3.10 Forms Change Mechanism

3.10.1 Forms change lever and gears

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the snap ring (x) and take off the forms change gear. (See Figure 3.60.)

(5) Remove the forms change lever and spring R.

(6) Remove the clutch gear holder and paper feed idle gear 47 (clutch gear) together.

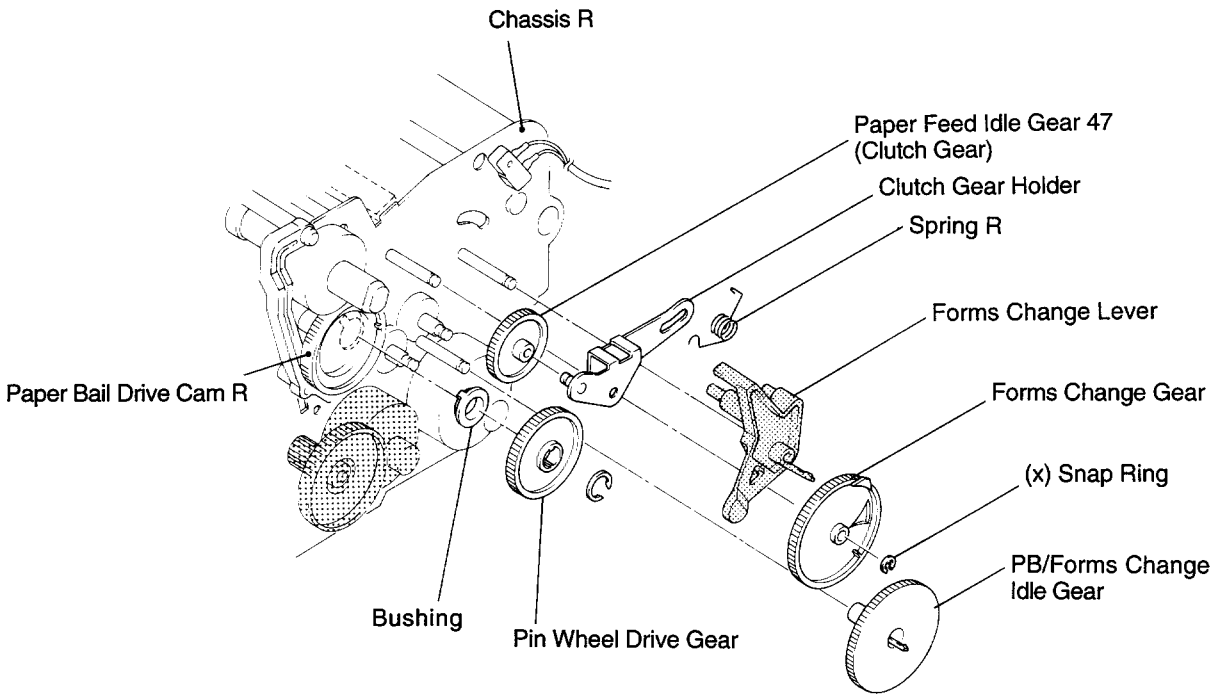


Figure 3.60 Removing the Forms Change Lever and Gears

(7) Remove the two rear chassis pressure plates, raise the rear end of the chassis unit, and support it with the platen knob. (See Figure 3.63.)

(8) Remove the PB/forms change idle gear.

b. Installation

Reverse the removal procedure.

NOTE: When installing the forms change gear, align the marking on it with that on the paper bail drive cam R.

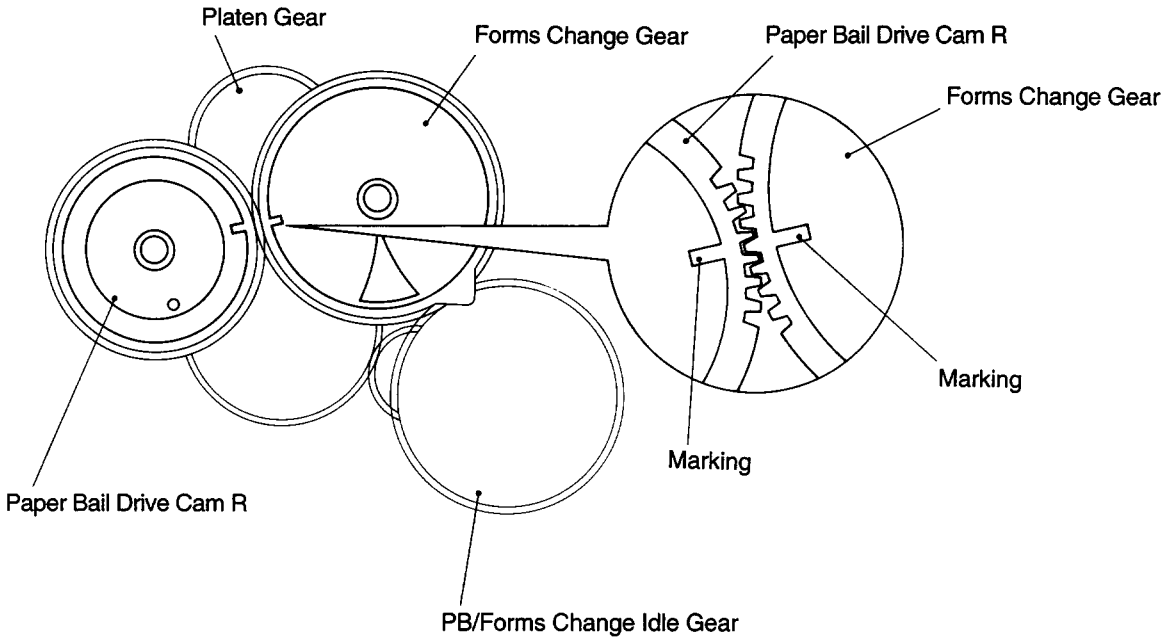


Figure 3.61 Installing the Forms Change Gear

3.10.2 Paper bail/forms change motor

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the chassis unit. (Refer to Section 3.3.)

(5) Remove the PB/forms change idle gear.

(6) Remove the two screws (y) and take the paper bail/forms change motor off the chassis R.

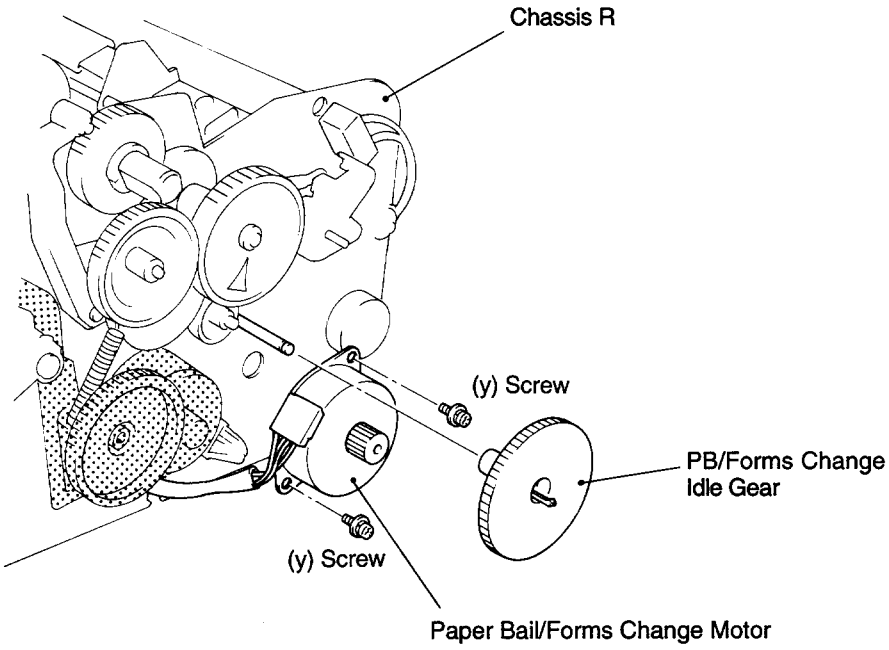


Figure 3.62 Removing the Paper Bail & Forms Change Motor

b. Installation

Reverse the removal procedure.

NOTE: For the routing of the motor harness, refer to Figure 3.110.

3.11 Tractor Feeder

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the chassis pressure plates securing the rear end of the chassis unit. (Refer to Figure 3.27.)

(5) Raise the rear end of the chassis unit and support it with the platen knob.

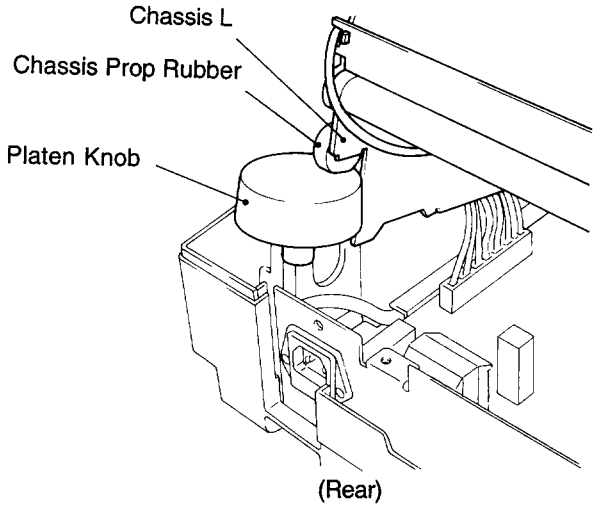


Figure 3.63 Supporting the Rear End of Chassis with the Platen Knob

(6) Disconnect the PE relay connector of the paper empty switch ASSY. (See Figure 3.64.)

(7) Remove the rubber bushing from the main paper guide.

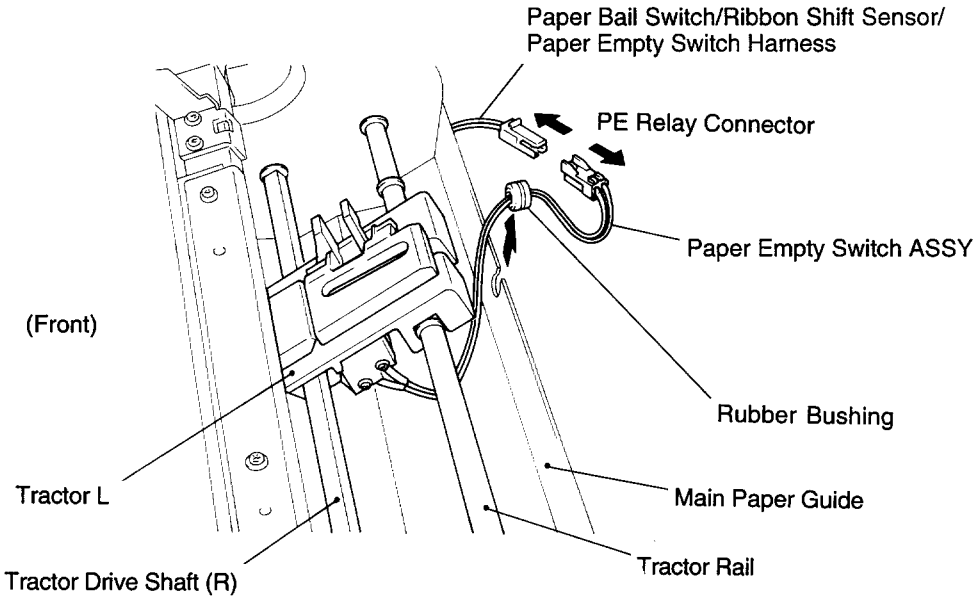


Figure 3.64 Disconnecting the PE Relay Connector

(8) Remove the PB/forms change idle gear. (See Figure 3.65.)

(9) Remove the snap ring (x), the forms change gear, forms change lever, and spring R.

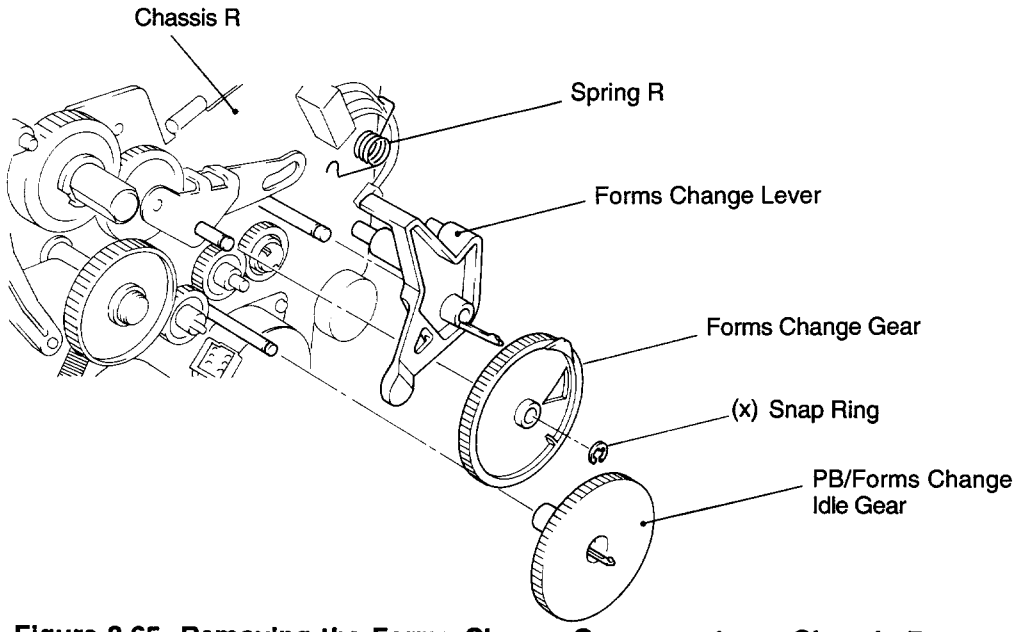


Figure 3.65 Removing the Forms Change Components on Chassis R

(10) Remove the two paper feed idle gears 30. (See Figure 3.66.)

(11) Remove the snap ring, pin wheel drive gear, and bushing from the right end of the tractor drive shaft (F).

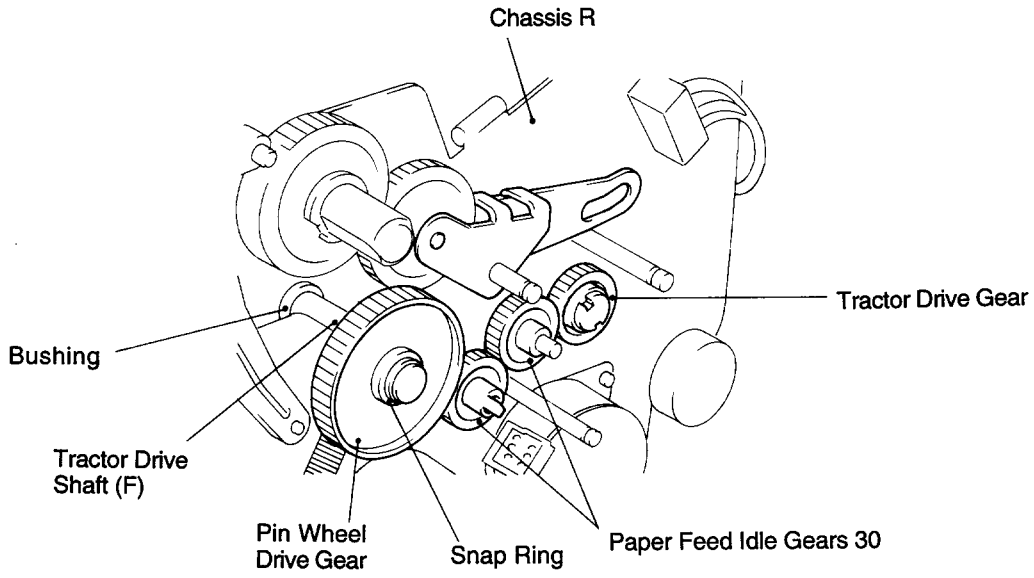


Figure 3.66 Removing the Paper Feed Idle Gears and Pin Wheel Drive Gear

(12) Remove the three snap rings from the tractor rail. (See Figure 3.67.)

(13) Unlock tractor L and move it to the right.

(14) Unlock both tractors and pull out the tractor rail towards the left of the printer.

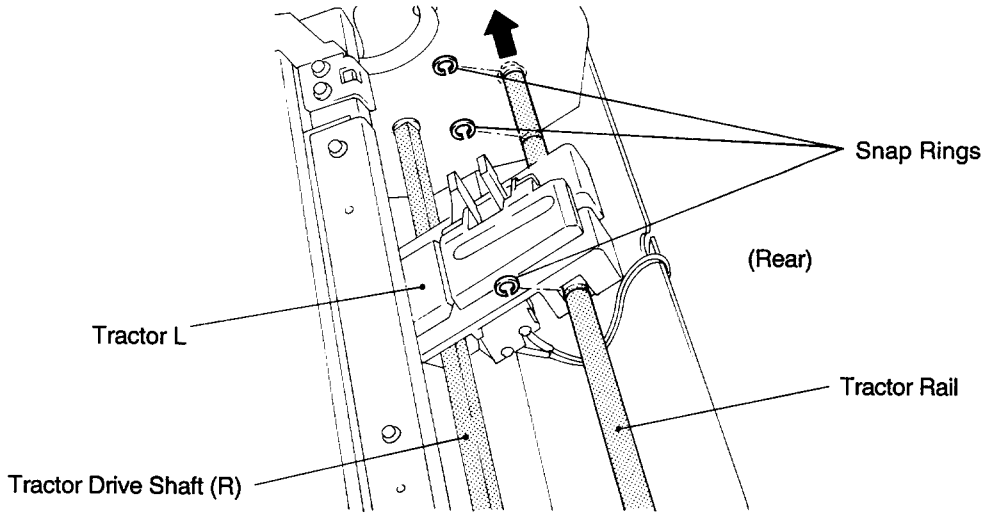


Figure 3.67 Pulling out the Tractor Rail to the Left

(15) Remove the snap ring, washer, and bushing from the left ends of the tractor drive shafts (F) and (R) each.

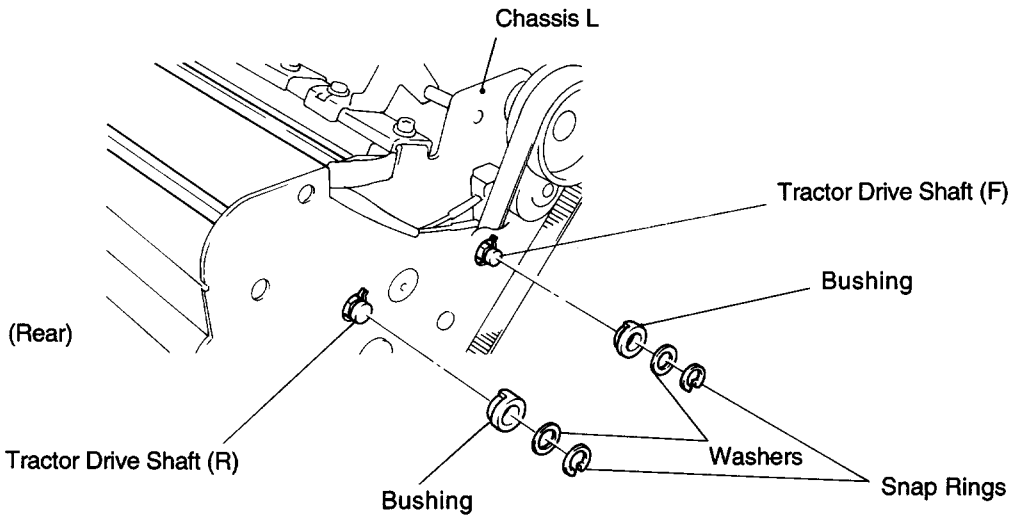


Figure 3.68 Removing the Snap Rings, Washers, and Bushings from the Tractor Drive Shafts

(16) Remove the snap ring, tractor drive gear, and bushing from the right end of the tractor drive shaft (R).

(17) Gather tractors R and L as illustrated in Figure 3.69. Then, pushing the tractor drive shafts (F) and (R) towards the left, remove them towards the rear together with the tractors R and L, a pair of the paper guide rollers, and three springs.

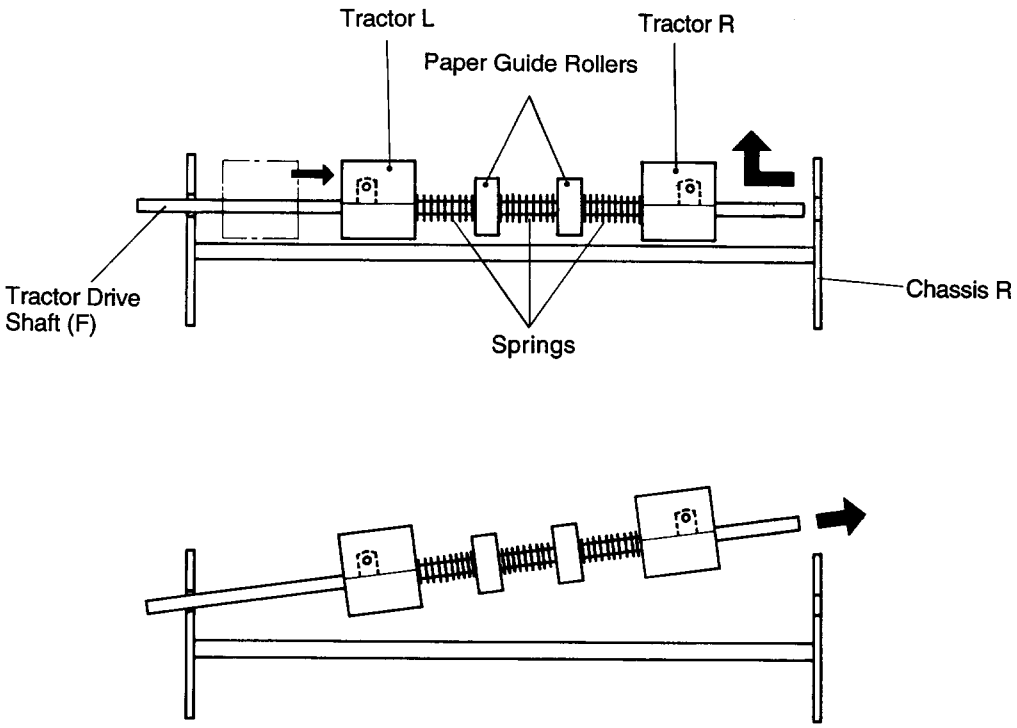


Figure 3.69 Removing Tractor Drive Shafts (F) and (R)

b. Installation

(1) Adjust the paper empty switch by loosening the two screws so that the switch operates just when the test paper comes in the range from scratch (a) to (b).

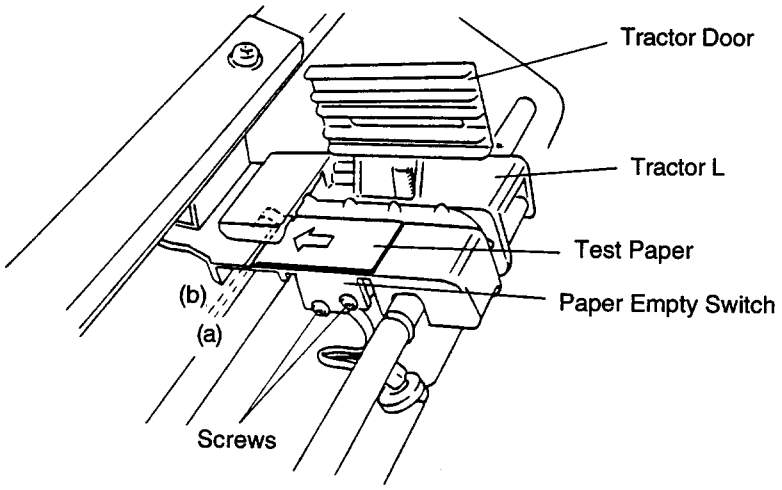


Figure 3.70 Checking the Paper Empty Switch

(2) After tightening the two screws, move the test paper to recheck that the sensing point lays within the range from scratch (a) to (b).

(3) While aligning the phases of the pin wheels on both tractors each other, insert the tractor drive shaft (F) through three springs, a pair of paper guide rollers, and tractors R and L.

(4) Check that the phases of the pin wheels are aligned with each other, insert the tractor drive shaft (R) through tractors R and L.

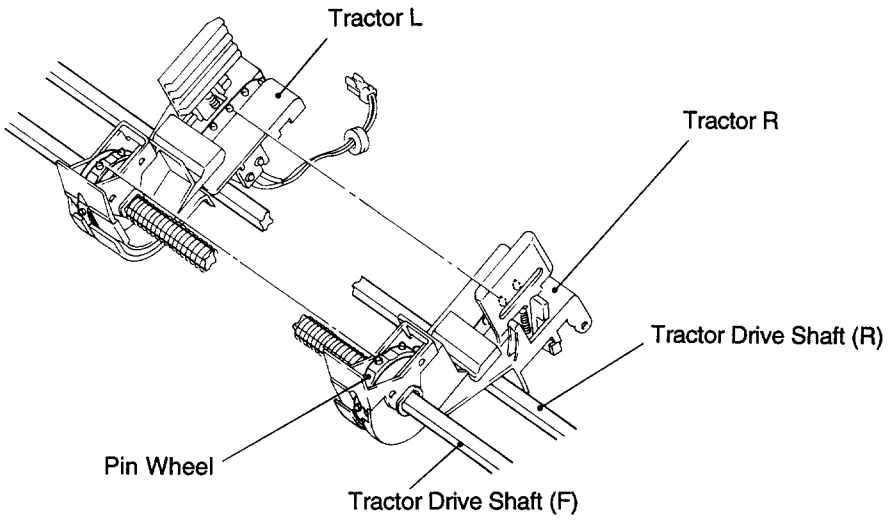


Figure 3.71 Inserting the Tractor Drive Shafts (F) and (R)

(5) Install the tractor drive shafts (F) and (R) to the chassis as illustrated in Figure 3.72.

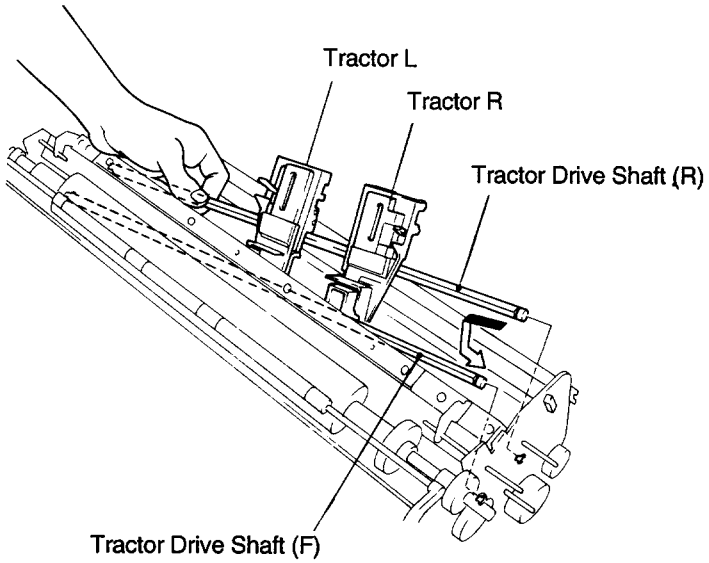


Figure 3.72 Installing the Tractor Drive Shafts (F) and (R)

(6) Insert the tractor rail through tractors R and L, then set the three snap rings on the tractor rail.

(7) Set the bushing, washer, and snap ring onto the left ends of the tractor drive shafts (F) and (R) each.

(8) Install the bushing, pin wheel drive gear, and snap ring to the tractor drive shaft (F) so that the marking on the pin wheel drive gear, the wheel pin position, and the shaft direction are as shown in Figure 3.73.

(9) Install the two paper feed idle gears 30 so that the markings on those gears and on the pin wheel drive gear are aligned with each other as shown in Figure 3.73.

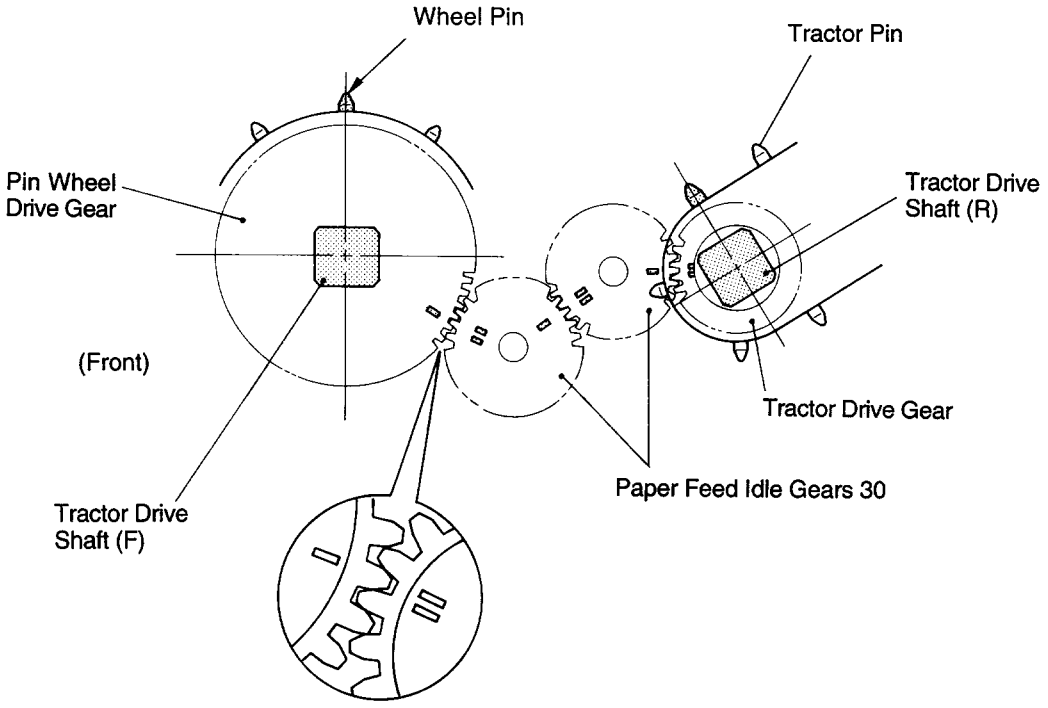


Figure 3.73 Installing the Pin Wheel Drive Gear, Paper Feed Idle Gears 30, and Tractor Drive Gear

(10) Set the tractor drive gear onto the tractor drive shaft (R) so that the marking, wheel pin position, and the shaft direction are as shown in Figure 3.73.

(11) Install the spring R, forms change lever, forms change gear, and snap ring (x) on chassis R. (See Figure 3.65.)

(12) Install the PB/forms change idle gear. (See Figure 3.65.)

(13) Set the rubber bushing of the paper empty switch ASSY into the main paper guide.

(14) Connect the PE relay connector.

(11) Remove the platen knob, lower the chassis unit, and lock the rear end of the chassis with the chassis pressure plates.

(12) Install the body cover, ribbon cassette, and top cover.

3.12 Paper Bail Mechanism

3.12.1 Paper bail pipe and shaft

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the snap ring (w) from the left end of the paper bail shaft. (See Figure 3.74.)

(4) Shift the paper bail shaft to the left and pull out the right end of the shaft from the paper bail lever R. Then, pull out the left end of the shaft from the paper bail lever L.

(5) Remove the snap rings (x) securing the paper bail pipe, then pull out the paper bail shaft from the pipe.

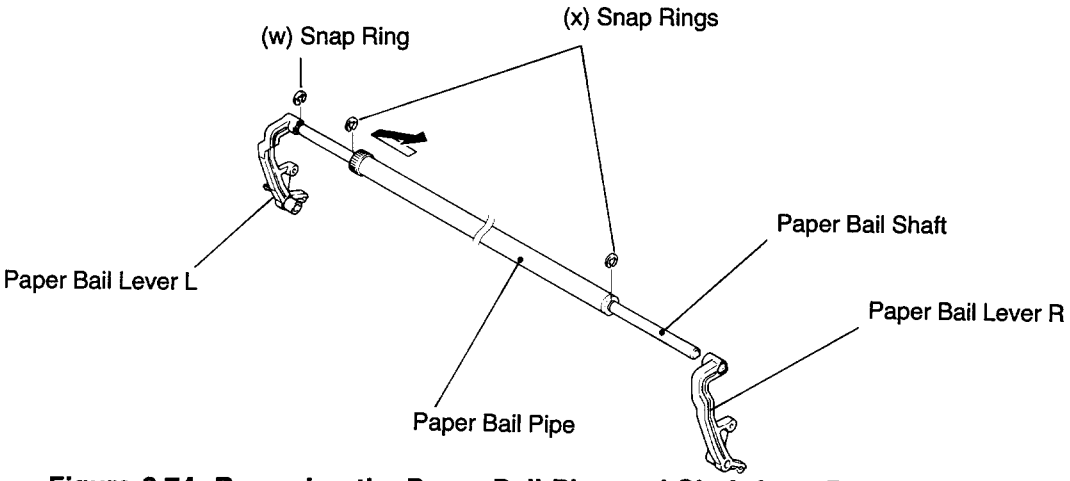


Figure 3.74 Removing the Paper Bail Pipe and Shaft from Paper Bail Levers

b. Installation

Reverse the removal procedure.

NOTE: Fit the round end of the paper bail shaft into the paper bail lever L and then fit the convex end into the paper bail lever R.

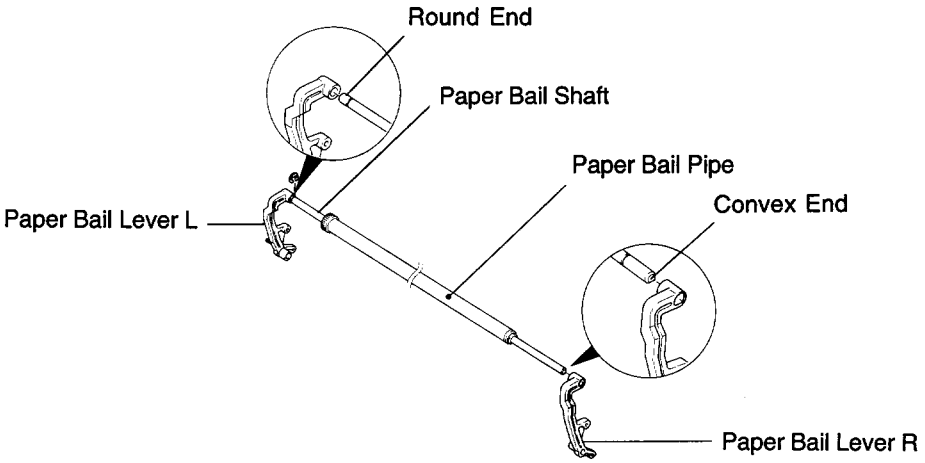


Figure 3.75 Fitting the Paper Bail Lever

3.12.2 Paper bail levers and paper bail drive cams

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the paper bail pipe and shaft. (Refer to Subsection 3.12.1.)

(5) Unhook the spring (y) from the paper bail lever L and take off the lever. (See Figure 3.76.)

(6) Remove the snap ring from the paper bail drive cam L.

(7) Holding the paper bail drive cam L by hand, pull out the paper bail drive cam R to the right together with the connecting rod.

(8) Unhook the spring (z) from the paper bail lever R and remove the snap ring.

(9) Remove the snap ring from the paper bail lever R, then take off the lever.

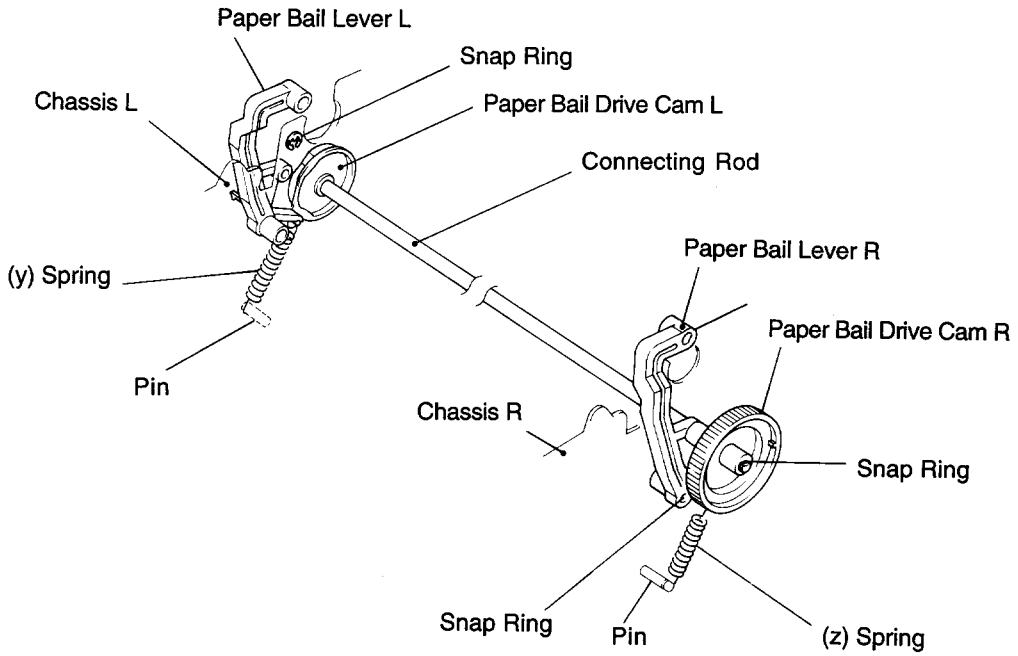


Figure 3.76 Removing the Paper Bail Levers and Paper Bail Drive Cams

b. Installation

(1) Hook one end of the spring (z) onto the paper bail lever R and hook the other end onto the pin provided on chassis R, then install the paper bail lever R to chassis R.

(2) Secure the paper bail lever R with the snap ring.

(3) Fit the paper bail drive cam R onto the connecting rod and set the snap ring onto the right end of the connecting rod.

(4) Insert the connecting rod through chassis R, chassis L, and paper bail drive cam L.

NOTE: If the connecting rod is replaced with a new one, apply Epinoc grease to the joints between the connecting rod and the chassis.

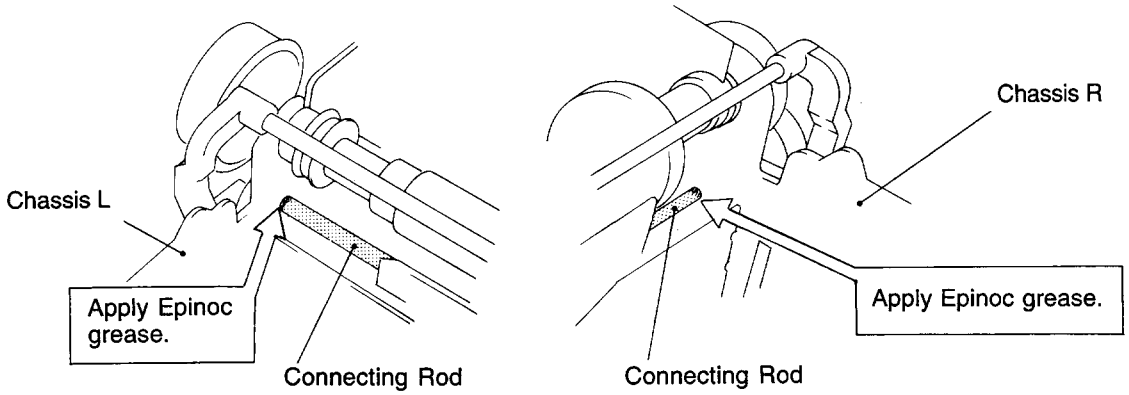


Figure 3.77 Lubricating the Joints between the Connecting Rod and Chassis

(5) Align the marking on the paper bail drive cam R with that on the forms change gear.

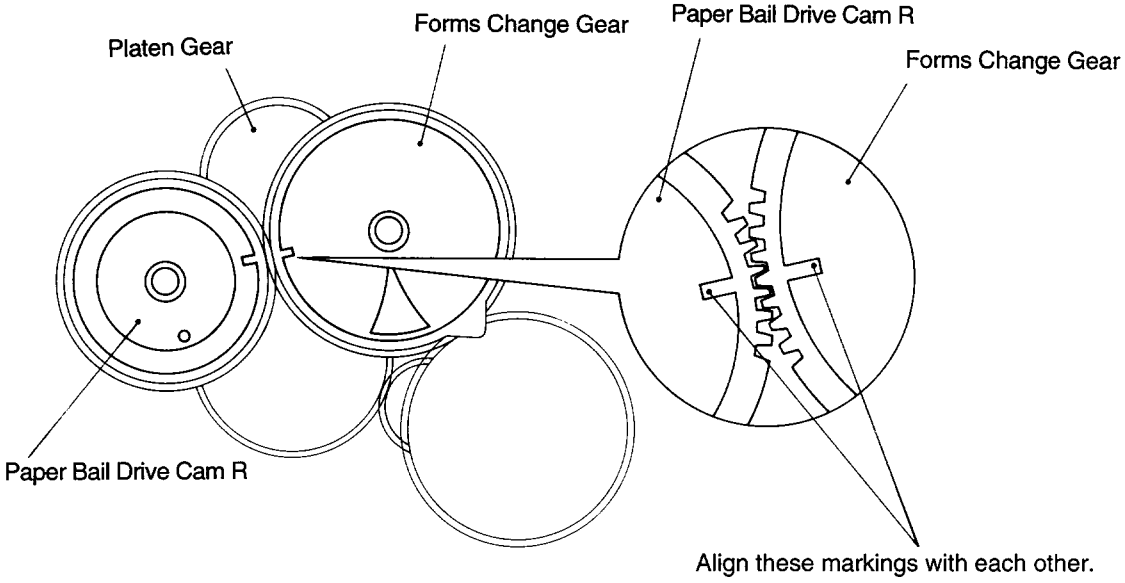

Platen Gear
Forms Change Gear
Paper Bail Drive Cam R
Forms Change Gear
Paper Bail Drive Cam R
Align these markings with each other.

Figure 3.78 Aligning the Phases of the Paper Bail Drive Cam R and Forms Change Gear

(6) Set the snap ring onto the left end of the connecting rod.

(7) Install the paper bail pipe and shaft.

(8) Hook one end of the spring (y) onto the paper bail lever L and hook the other end onto the pin provided on chassis L, then install the paper bail lever L to chassis L.

(9) If any of the paper bail levers R and L, and the paper bail drive cams R and L are replaced with new ones, apply Epinoc grease to the slideway on the paper bail drive cam.

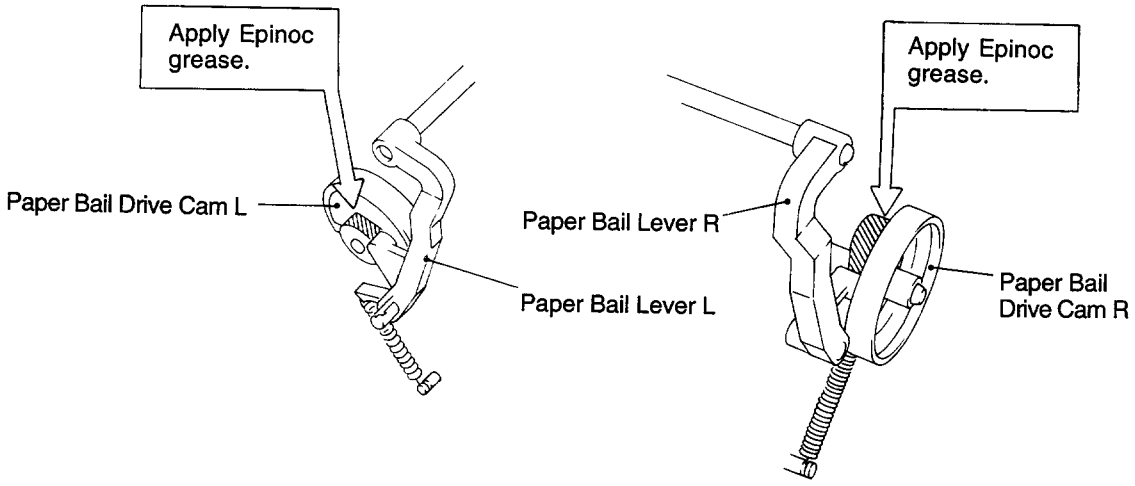

Apply Epinoc grease.
Paper Bail Drive Cam L
Paper Bail Lever L
Apply Epinoc grease.
Paper Bail Lever R
Paper Bail Drive Cam R

Figure 3.79 Lubricating the Slideway on Paper Bail Drive Cam

(10) Install the body cover, ribbon cassette, and top cover.

3.13 Carrier Motor

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the two chassis pressure plates securing the front end of the chassis unit. (Refer to Figure 3.10.)

(5) Raise the front end of the chassis unit and support it with the platen knob. (Refer to Figure 3.81.)

(6) Disconnect the carrier motor harness from the main PCB and take it out of the shell clip. (Refer to Figure 3.22.)

(7) Disconnect the carrier motor encoder harness from the main PCB and take it out of the hook provided on the front chassis. (Refer to Figure 3.22.)

(8) For those models equipped with the automatic head-adjust mechanism, remove the two screws (c) and take off the head-adjust motor and head-adjust idle gear from chassis R.

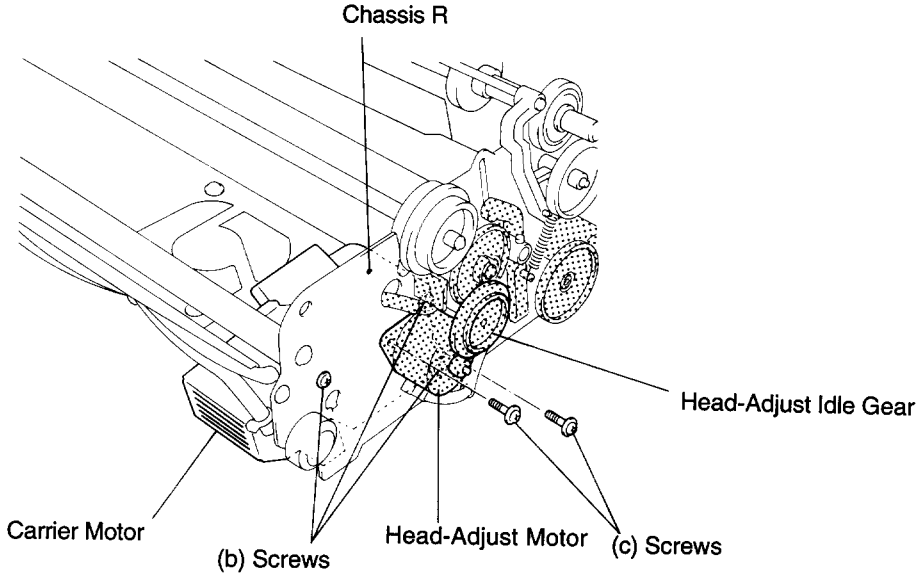


Figure 3.80 Removing the Carrier Motor

(9) Loosen the double nuts (d) securing the idle pulley holder (see Figure 3.81), then remove the carrier timing belt from the idle pulley.

(10) Holding the carrier motor by hand, remove the three screws (b) and take the carrier motor down and out of the chassis. (See Figure 3.80.)

b. Installation

Reverse the removal procedure.

NOTES
- Be sure to route the carrier motor harness and encoder harness through the shell clip and the hook, respectively.
- Adjust the tension of the carrier timing belt. (Refer to Section 3.14.)

3.14 Carrier Timing Belt

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the two chassis pressure plates securing the front end of the chassis unit. (Refer to Figure 3.10.)

(5) Raise the front end of the chassis unit and support it with the platen knob. (See Figure 3.81.)

(6) Remove the double nuts (d) securing the idle pulley holder.

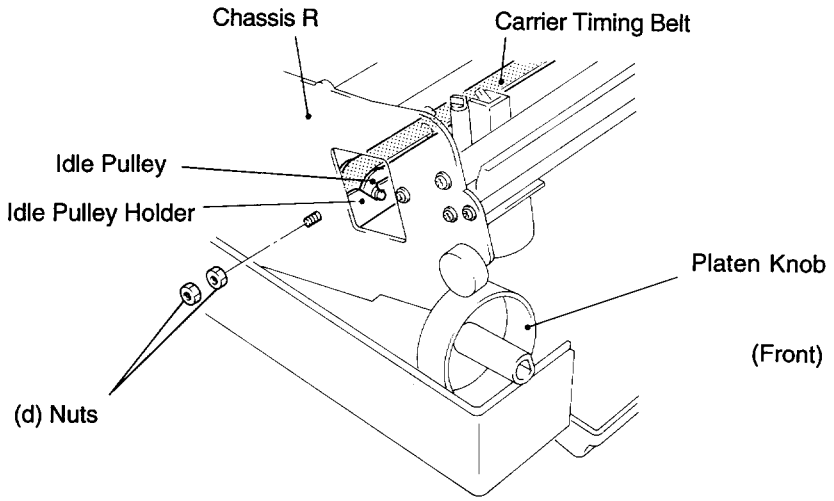


Figure 3.81 Removing the Double Nuts

(7) Remove the platen knob and lower the front end of the chassis.

(8) Remove the print head. (Refer to Section 3.1.)

(9) Remove the screw (o) and belt clamp to make the timing belt free from the carrier.

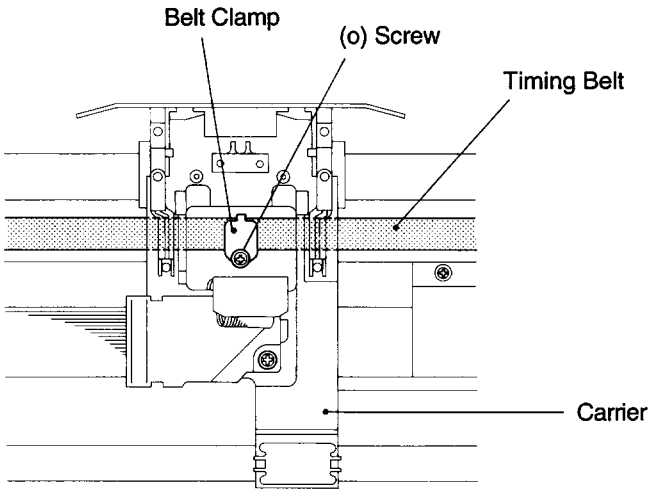


Figure 3.82 Removing the Belt Clamp

(9) Remove the carrier timing belt.

b. Installation

(1) Route the carrier timing belt around the tension pulley and carrier motor pulley.

(2) Raise the front end of the chassis unit and support it with the platen knob.

(3) Temporarily tighten the double nuts.

(4) Move the carrier to the right end of its travel.

(5) Apply a vertical load of 300 g to the center of the belt span.

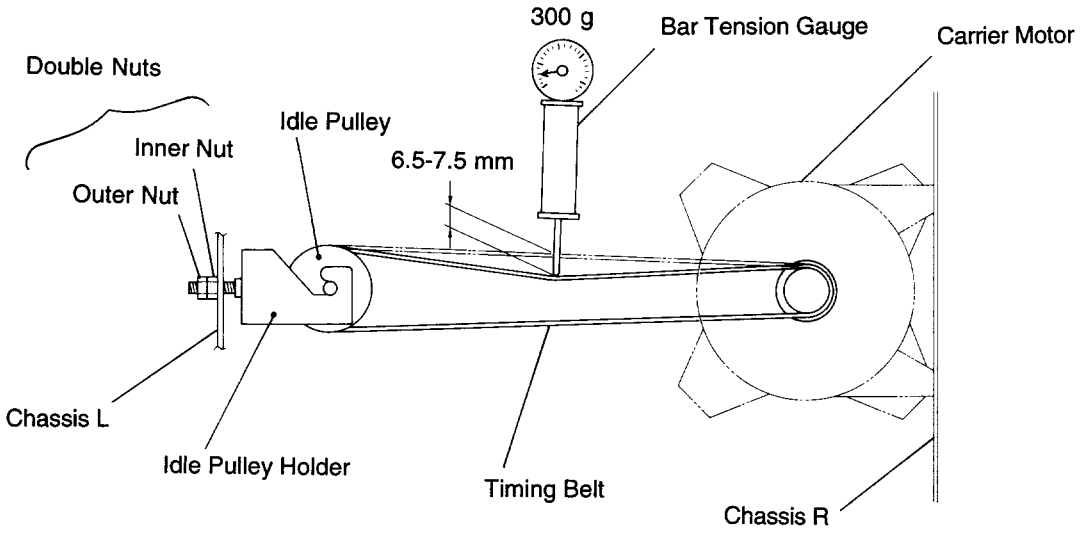


Figure 3.83 Adjusting the Tension of Carrier Timing Belt

(6) Adjust the idle pulley holder with the inner nut so that the belt deflection is within the range from 6.5 mm to 7.5 mm, then tighten the outer nut while taking care not to turn the inner nut.

(7) Remove the platen knob, lower the front end of the chassis, and lock it with the chassis pressure plates.

(8) Following the natural belt path, secure the timing belt to the carrier with the belt clamp and the screw (o).

After tightening the screw (o), move the carrier to the right and left to check the timing belt on the idle pulley and the carrier motor pulley. If the timing belt deviates to the front and rear of the printer so much, take off the belt clamp and readjust the belt mounting position on the carrier.

(9) Install the print head.

(10) Install the body cover, ribbon cassette, and top cover.

3.15 Paper Feed Motor

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the two chassis pressure plates securing the rear end of the chassis unit. (Refer to Figure 3.10.)

(5) Raise the rear end of the chassis unit and support it with the platen knob. (Refer to Figure 3.88.)

(6) Disconnect the paper feed motor harness from the main PCB. (Refer to Figure 3.22.)

(7) Holding the paper feed motor by hand, remove the two screws (e) securing the paper feed motor.

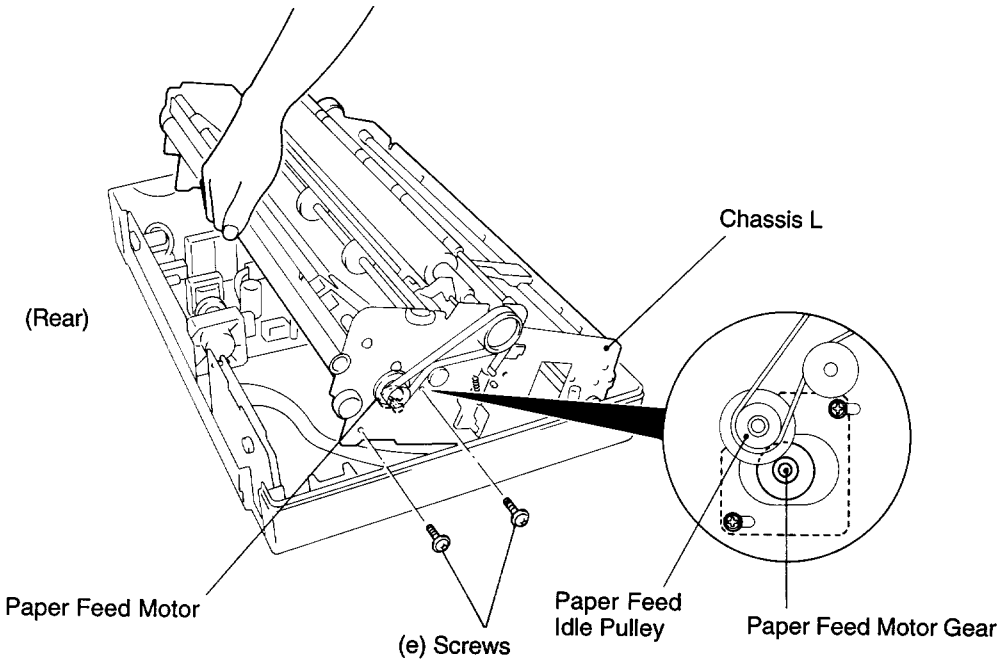


Figure 3.84 Removing the Paper Feed Motor

b. Installation

Reverse the removal procedure.

NOTES
- When tightening the two screws (e), lightly press the paper feed motor gear against the paper feed idle pulley to eliminate backlash between them.
- For the routing of the motor harness, refer to Figure 3.110.

3.16 Paper Feed Timing Belt

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the two chassis pressure plates securing the rear end of the chassis unit. (Refer to Figure 3.10.)

(5) Raise the rear end of the chassis unit and support it with the platen knob. (Refer to Figure 3.88.)

(6) Loosen the screw (f) securing the tension pulley holder and remove the timing belt.

b. Installation

Reverse the removal procedure.

NOTE: Temporarily tighten the screw (f). Apply a 300 g load to the center of the belt span and adjust the tension pulley holder so that the belt deflection is within the range from 3 mm to 4 mm. Then, firmly tighten the screw (f).

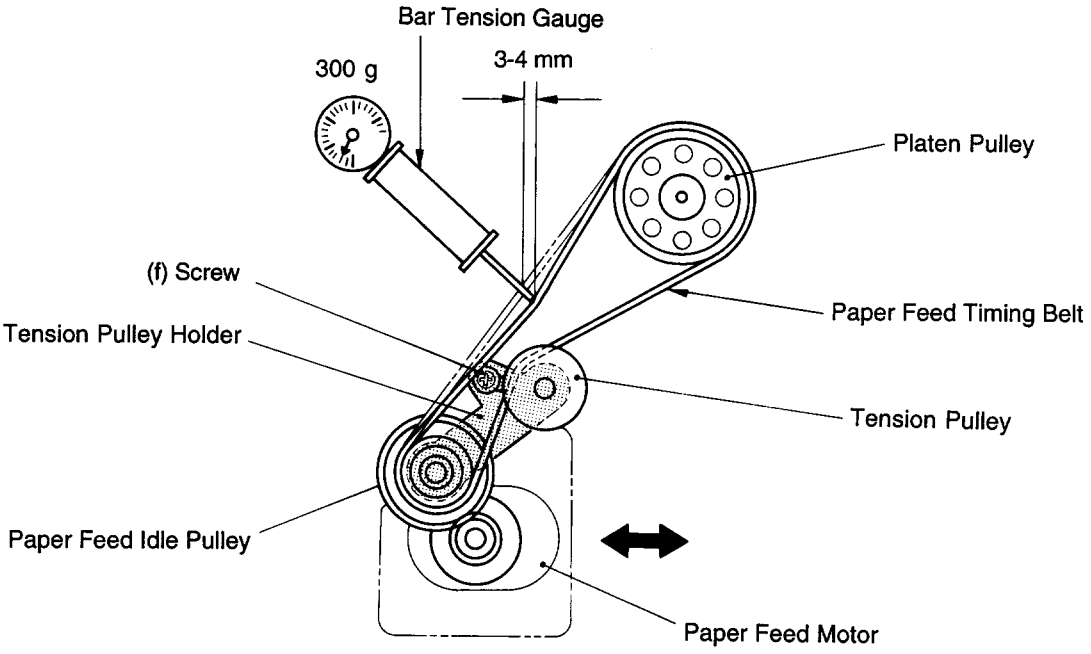


Figure 3.85 Adjusting the Tension of Paper Feed Timing Belt

3.17 Ribbon Drive ASSY

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the two chassis pressure plates securing the front end of the chassis unit. (Refer to Figure 3.10.)

(5) Raise the front end of the chassis unit and support it with the platen knob. (See Figure 3.86.)

(6) Disconnect the ribbon drive motor harness from the main PCB. (Refer to Figure 3.22.)

(7) Remove the two screws (g) securing the ribbon drive motor and take off the ribbon drive ASSY.

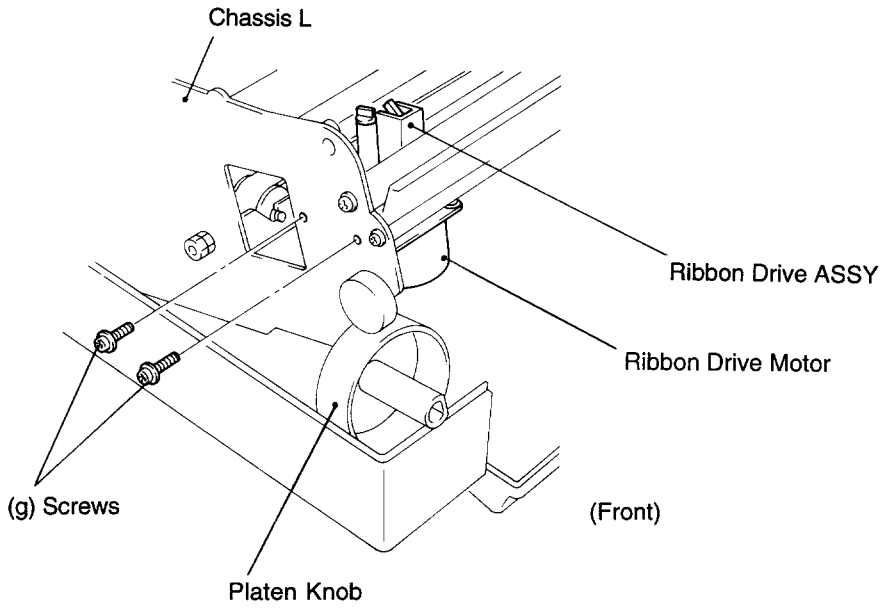


Figure 3.86 Removing the Ribbon Drive ASSY

b. Installation

Reverse the removal procedure.

NOTE: For the routing of the motor harness, refer to Figure 3.110.

3.18 Ribbon Shift Mechanism (Only for the models which apply)

3.18.1 Ribbon shift guides, ribbon shifters, and ribbon shift guide plate

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the print head. (Refer to Section 3.1.)

(5) Move the carrier to the center of its travel.

(6) Pressing the ribbon shift guide plate towards the front of the printer, lift the ribbon shift guides R and L up and out of the carrier.

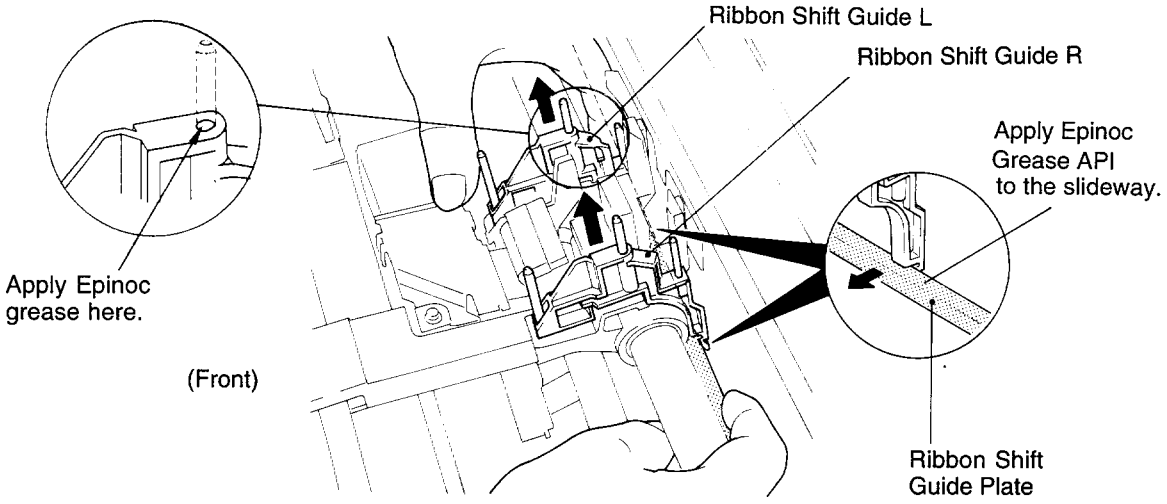

Ribbon Shift Guide L
Ribbon Shift Guide R
Apply Epinoc Grease API to the slideway.
Apply Epinoc grease here.
(Front)
Ribbon Shift Guide Plate

Figure 3.87 Removing the Ribbon Shift Guides R and L

(7) Remove the two chassis pressure plates securing the rear end of the chassis unit. (Refer to Figure 3.10.)

(8) Raise the rear end of the chassis unit and support it with the platen knob.

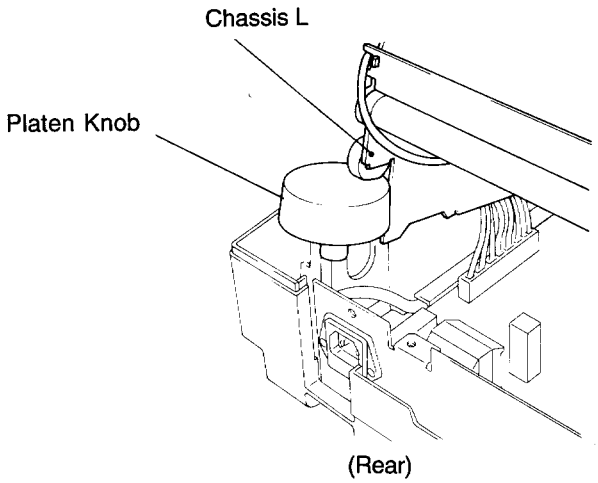


Figure 3.88 Supporting the Rear End of Chassis Unit

(9) Remove the snap ring (h) and the paper bail drive cam R.

(10) Remove the snap ring (z), paper bail lever R, and spring.

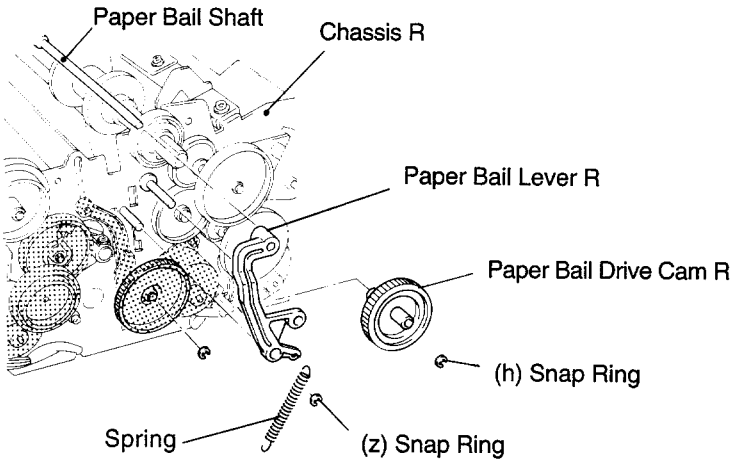


Figure 3.89 Removing the Paper Bail Drive Cam R and Paper Bail Lever R

(11) Pull out the paper bail shaft.

(12) Remove the snap ring, paper bail lever L, and spring.

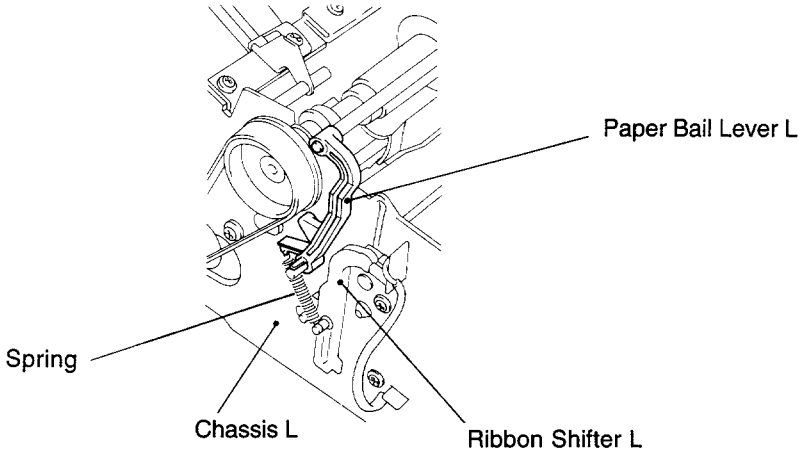


Figure 3.90 Removing the Paper Bail Lever L

(13) Remove the snap ring (i) and shift the connecting rod to the left to take off the ribbon shift gear R.

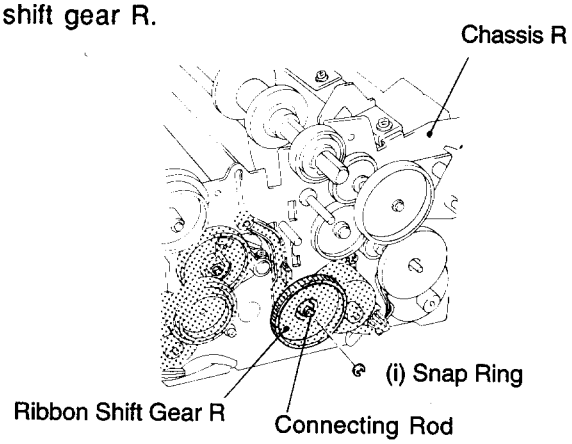


Figure 3.91 Removing the Ribbon Shift Gear R

(14) Lift up the rear end of the chassis unit and remove the ribbon shift gear L and the connecting rod.

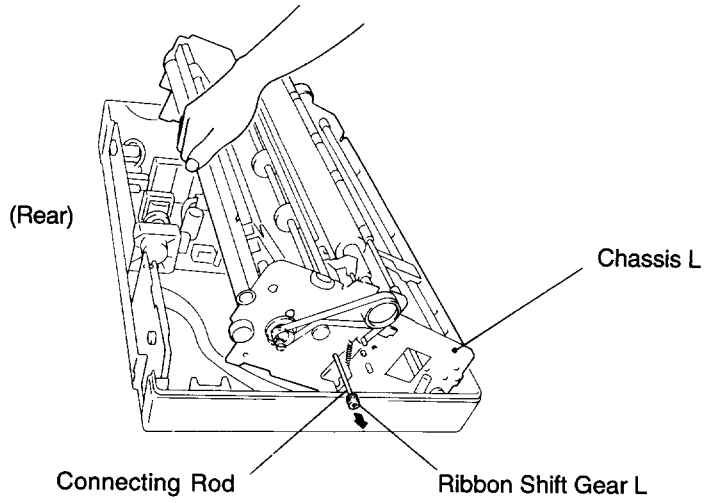


Figure 3.92 Removing the Ribbon Shift Gear L and Connecting Rod

(15) Remove the snap ring and washer from each of the ribbon shifters R and L.

(16) Lift up the ribbon shifters R and L to the uppermost position, then pull them out to the horizontal direction.

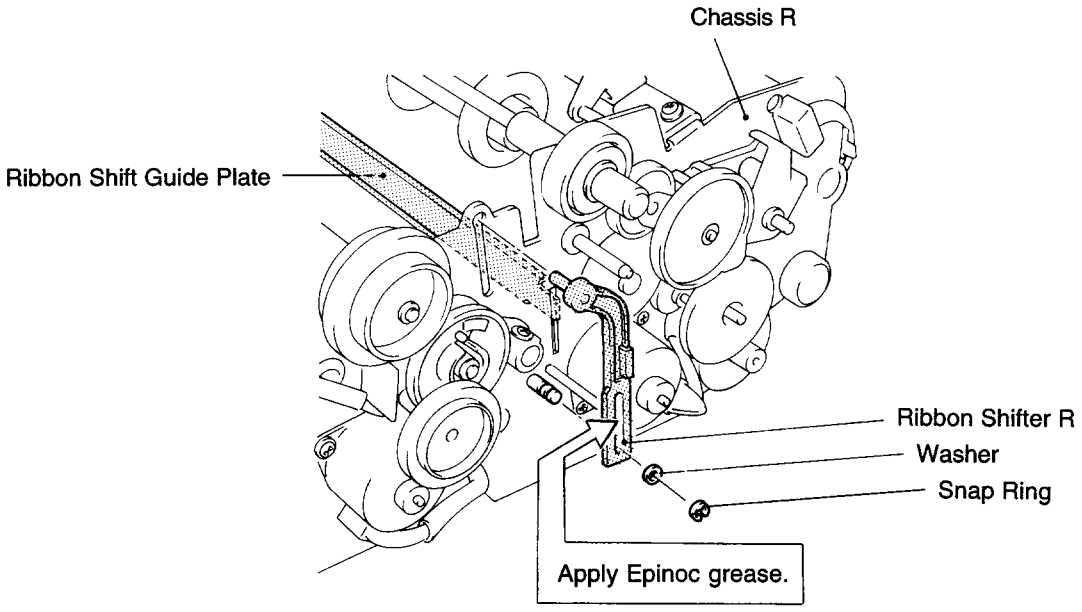


Figure 3.93 Removing the Ribbon Shifters

(17) Remove the ribbon shift guide plate. (See Figure 3.93.)

b. Installation

(1) Install the ribbon shifter R to the chassis R with the washer and snap ring. (See Figure 3.93.)

(2) Set the ribbon shift guide plate to the ribbon shifter R, taking care not to mistake the mounting direction. (See Figure 3.93.)

(3) Install the ribbon shifter L to the chassis L with the washer and snap ring.

(4) Set the ribbon shift guide plate to the ribbon shifter L.

(5) Apply Epinoc grease to the oblong holes provided in the ribbon shifters.

(6) Lift up the rear end of the chassis unit as illustrated in Figure 3.92 and insert the connecting rod with the ribbon shift gear L.

(7) Make sure that the ribbon shifters R and L are placed at the lowermost position, then fit the ribbon shift gear R onto the connecting rod.

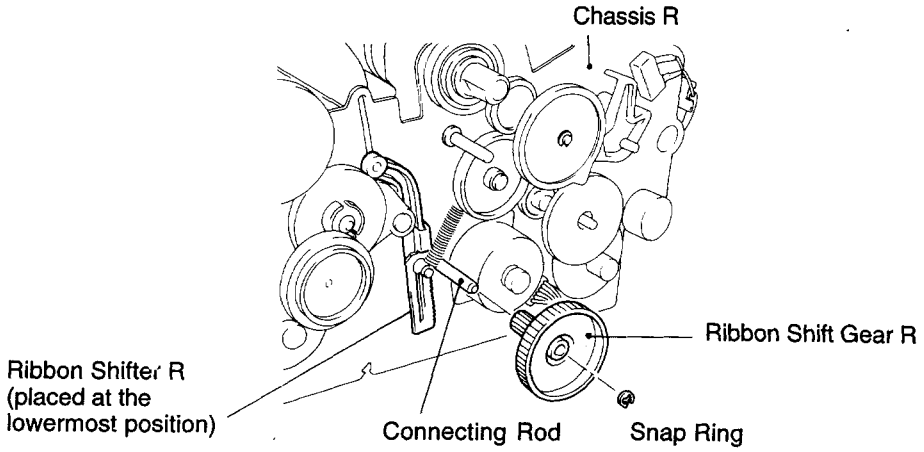


Figure 3.94 Fitting the Ribbon Shift Gear R onto the Connecting Rod

(8) Set the snap ring to the ribbon shift gear R.

(9) Install the paper bail lever R, spring, and snap ring.

(10) Install the paper bail shaft together with the paper bail lever L and spring.

(11) Install the paper bail drive cam R so that the marking on it is aligned with that on the forms change gear.

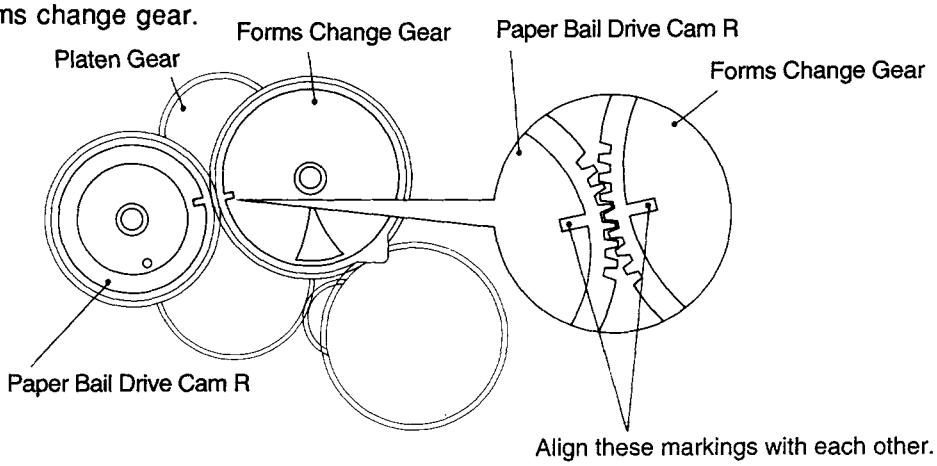

Forms Change Gear
Paper Bail Drive Cam R
Platen Gear
Forms Change Gear
Paper Bail Drive Cam R
Align these markings with each other.

Figure 3.95 Aligning the Phases of the Paper Bail Drive Cam R and Forms Change Gear

(12) Remove the platen knob, lower the rear end of the chassis, and lock it with the chassis pressure plates.

(13) Install the ribbon shift guides R and L.

If the ribbon shift guide is replaced with a new one, apply Epinoc grease to the hole holding the shaft of the carrier and to the slideway on the ribbon shift guide plate as shown in Figure 3.87.

(14) Install the print head. (Refer to Section 3.1.)

(15) Install the body cover, ribbon cassette, and the cover. (Refer to Subsection 3.2.1.)

(16) Adjust the ribbon shift amount by referring to Subsection 4.1.2, [7].

3.18.2 Ribbon shift motor (Only for the models which apply)

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the chassis unit from the bottom cover. (Refer to Section 3.3.)

(5) Remove the snap ring and the ribbon shift gear R. (See Figure 3.96.)

(6) Disconnect the motor harness from the ribbon shift motor.

(7) Remove the two screws (i) and take off the ribbon shift motor.

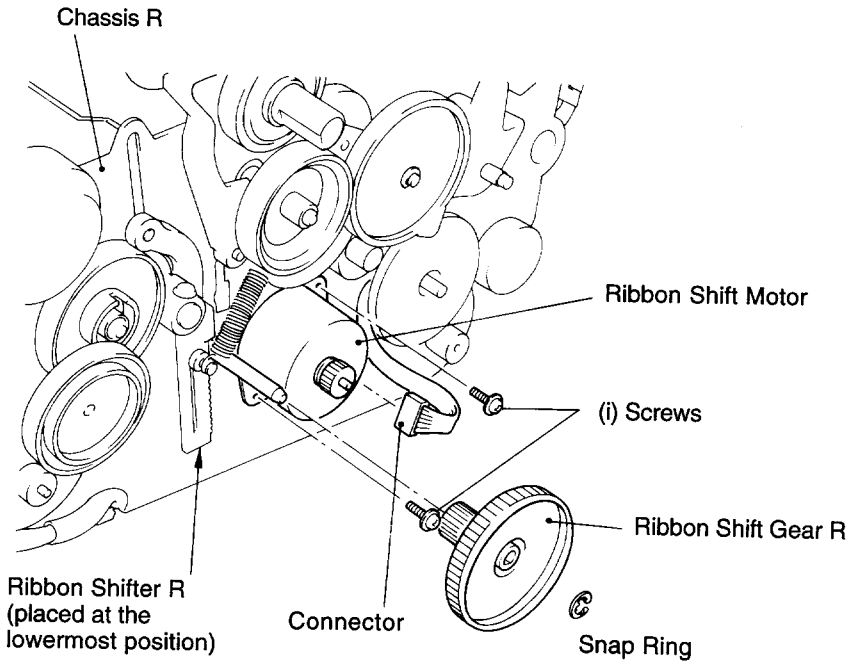


Figure 3.96 Removing the Ribbon Shift Motor

b. Installation

Reverse the removal procedure.

NOTE: Make sure that the ribbon shifters R and L are placed at the lowermost position before installing the ribbon shift gear R.

3.19 Head-adjust Mechanism

3.19.1 Automatic head-adjust mechanism (Only for the models which apply)

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the two chassis pressure plates securing the front end of the chassis unit. (Refer to Figure 3.10.)

(5) Raise the front end of the chassis unit and support it with the platen knob. (See Figure 3.86.)

(6) Remove the two screws (j), take off the head-adjust motor, and disconnect the motor harness. (See Figure 3.97.)

(7) Remove the head-adjust idle gear.

(8) Remove the snap ring and the head-adjust gear A with the torque spring.

(9) Remove the snap ring and manual head-adjust gear.

(10) Remove the screw (k) and head-adjust gear C.

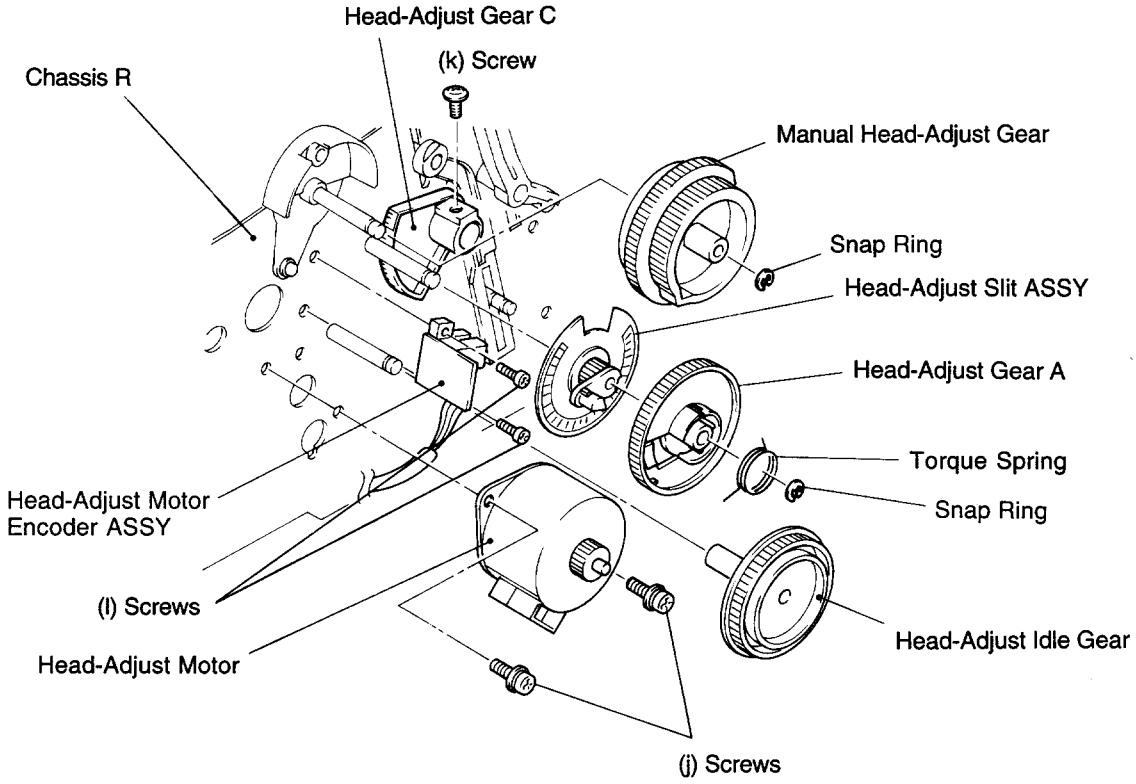


Figure 3.97 Removing the Head-adjust Motor, Head-adjust Idle Gear, Head-adjust Gears

(11) As shown in Figure 3.98, align the opening provided in the head-adjust slit ASSY with the encoder and remove the head-adjust slit ASSY.

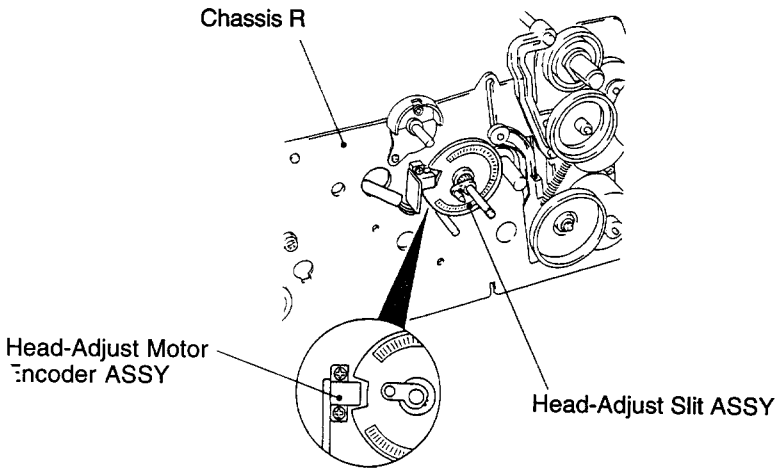


Figure 3.98 Removing the Head-adjust Slit ASSY

(12) Remove the two screws (I) and the head-adjust motor encoder ASSY. (See Figure 3.97)

b. Installation

(1) Route and clamp the harness of the head-adjust motor encoder ASSY on the head cable guide as shown in Figure 3.99, then secure the PCB ASSY with the two screws (I).

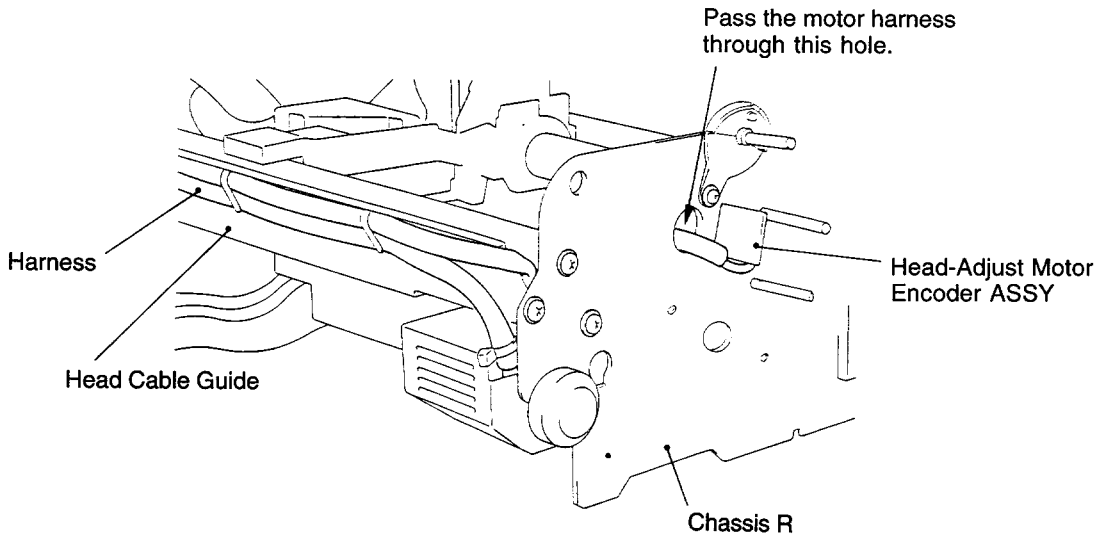


Figure 3.99 Installing the Head-adjust Motor Encoder ASSY

(2) Align the opening in the head-adjust slit ASSY with the encoder and install the slit ASSY. (Refer to Figure 3.98.)

(3) Secure the head-adjust gear C with the screw (k) so that its phase is aligned with the phase of the head-adjust slit ASSY and that the mounting angle is as shown in Figure 3.100 relative to the eccentric direction of the main carrier rail.

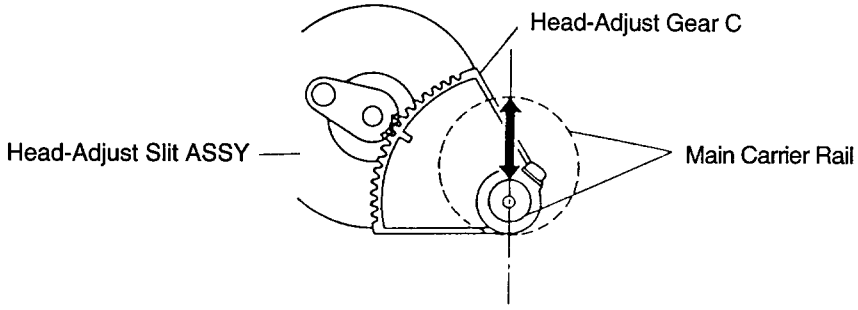


Figure 3.100 Installing the Head-adjust Gear C

(4) Secure the head-adjust gear A with the torque spring and snap ring. (See Figure 3.101.)

(5) Secure the manual head-adjust gear with the snap ring so that its phase is aligned with the phase of the head-adjust gear A.

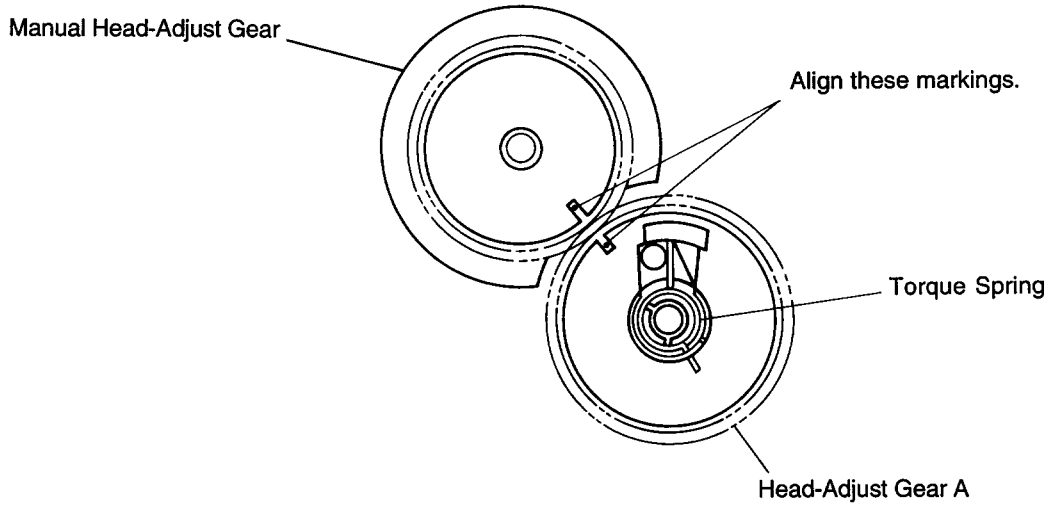


Figure 3.101 Installing the Head-adjust Gear A and Manual Head-adjust Gear

(6) Check that the torque spring attached to the head-adjust gear A works correctly, by rotating the main carrier rail in the direction of the arrow shown in Figure 3.102 and releasing it.

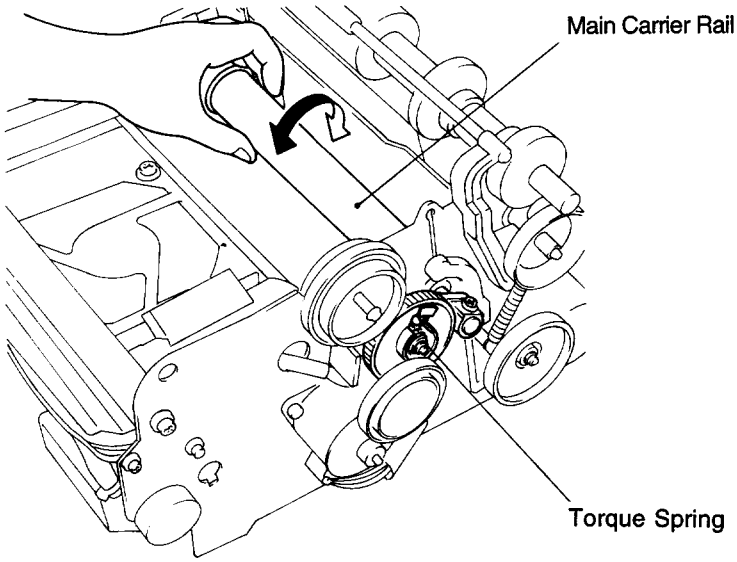


Figure 3.102 Checking the Torque Spring

(7) Set the head-adjust idle gear.

(8) Connect the head-adjust motor harness and secure the motor with the two screws (j).

(9) Remove the platen knob, lower the front end of the chassis unit, and lock it with the chassis pressure plates.

(10) Install the body cover.

(11) Check that the gap between the print head and the platen is 0.37 mm when the carrier is placed approx. 10 mm inwards from the left end of the platen. If the gap is not 0.37 mm, turn the manual head-adjust gear by hand to provide the specified gap.

Next, loosen the screw securing the head-adjust scale and turn the scale so that the pointer of the manual head-adjust gear is aligned with position "1" on the scale. Then, tighten the screw. (Refer to Figure 2.4.)

(12) Adjust the head-platen gap by referring to Subsection 4.1.2, [2], (A).

(13) Install the ribbon cassette and the top cover.

3.19.2 Manual head-adjust mechanism (Only for the models which apply)

a. Removal

(1) Remove the top cover. (Refer to Subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the two chassis pressure plates securing the front end of the chassis unit. (Refer to Figure 3.10.)

(5) Raise the front end of the chassis unit and support it with the platen knob. (See Figure 3.86.)

(6) Remove the snap ring and manual head-adjust gear.

(7) Remove the snap ring, head-adjust gear AB, and detent spring.

(8) Remove the screw (k) and head-adjust gear C.

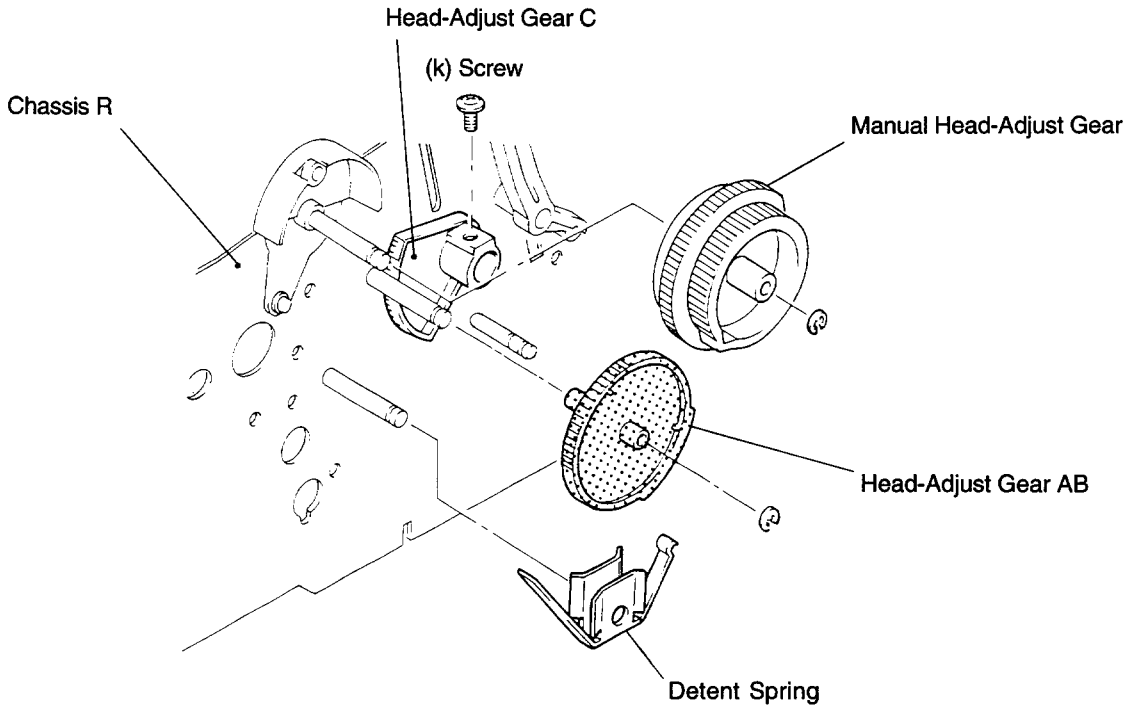


Figure 3.103 Removing the Manual Head-adjust Gear, Head-adjust Gears, and Detent Spring

b. Installation

(1) Secure the head-adjust gear C with the screw (k).

(2) Set the detent spring, head-adjust gear AB, and snap ring (see Figure 3.103) so that the phase of the head-adjust gear C is aligned with that of the head-adjust gear AB and that the mounting angle is as shown in Figure 3.104 relative to the eccentric direction of the main carrier rail.

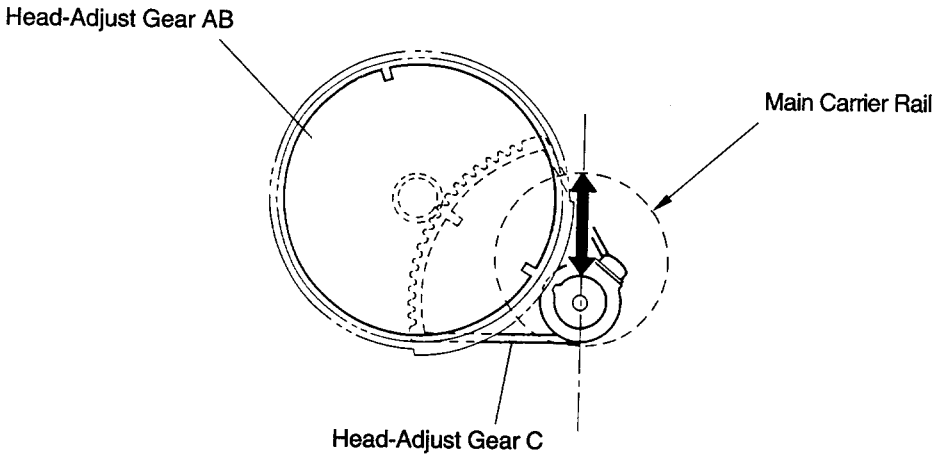


Figure 3.104 Installing the Head-adjust Gears AB and C

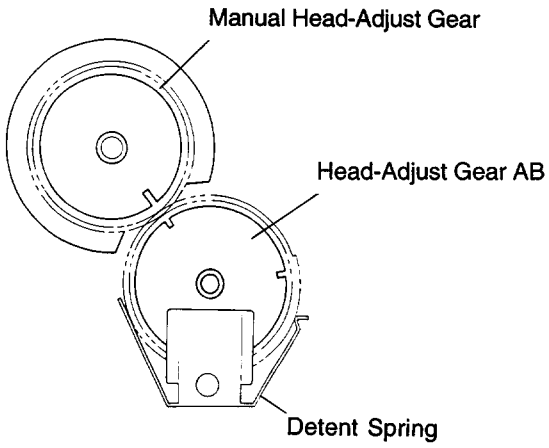


Figure 3.105 Installing the Head-adjust Gear AB and Manual Head-adjust Gear

(3) Secure the manual head-adjust gear with the snap ring so that its phase is aligned with the phase of the head-adjust gear AB. (See Figure 3.105.)

(4) Check that the detent spring attached to the head-adjust gear AB works correctly, by rotating the manual head-adjust gear.

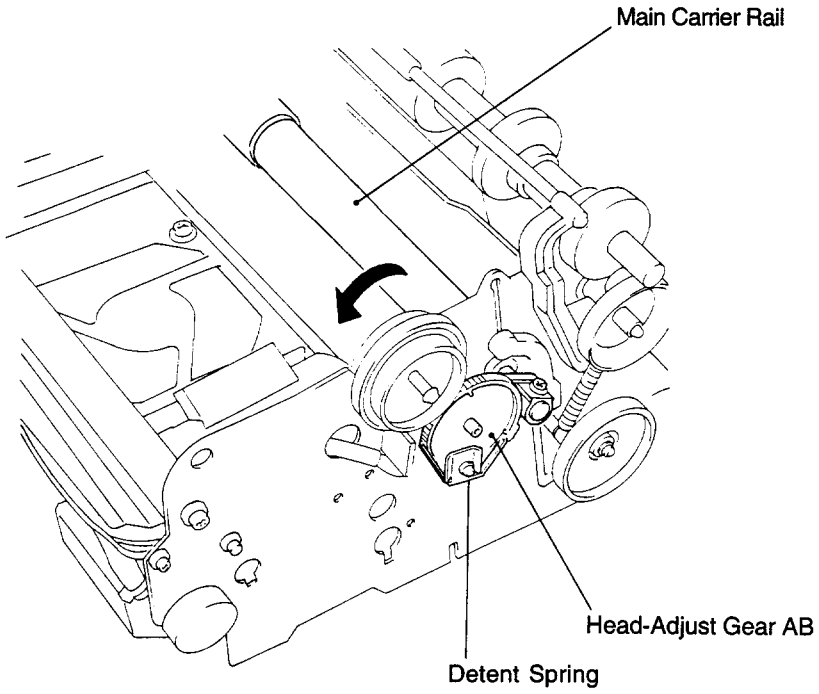


Figure 3.106 Checking the Detent Spring

(5) Remove the platen knob, lower the front end of the chassis unit, and lock it with the chassis pressure plates.

(6) Align the phase of the manual head-adjust gear with that of the head-adjust gear AB. (Refer to Figure 3.105.)

(7) Move the carrier to approx. 10 mm from the left end of the platen. Then, adjust the head-platen gap to 0.37 mm by inserting a pointed tool into the hole in the sub carrier rail and turning the sub carrier rail. (See Figure 3.48.)

(8) Loosen the screw securing the head-adjust scale and turn the scale to make the pointer indicate the "1" position. (Refer to Figure 3.47.) Then, tighten the screw.

(9) Install the body cover.

(10) Install the ribbon cassette and the top cover.

3.20 Cooling Fan #1

a. Removal

(1) Remove the top cover. (Refer to subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the chassis unit. (Refer to Section 3.3.)

(5) Place the chassis unit upright and remove the two screws from the cooling fan.

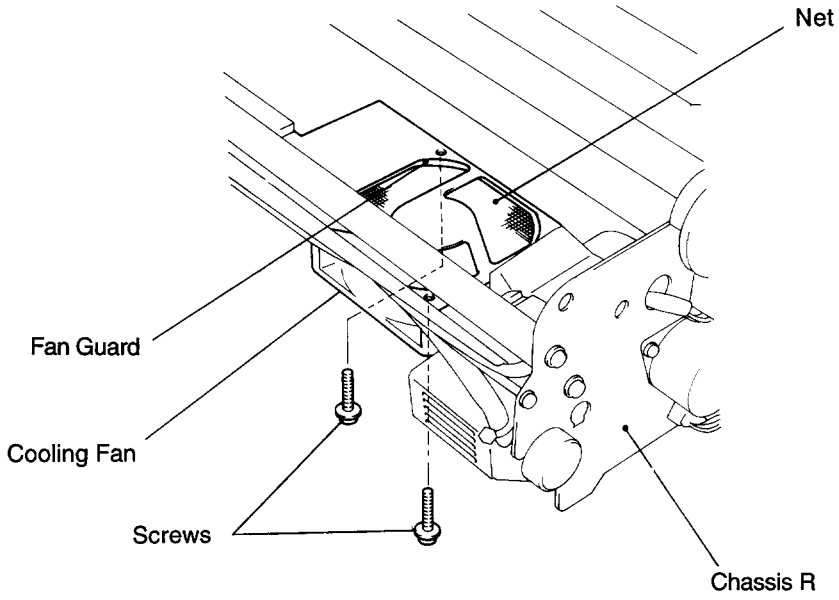


Figure 3.107 Removing the Chassis Unit

(6) Take out the fan harness from the shell clip.

(7) Remove the cooling fan, net, and fan guard.

b. Installation

Reverse the removal procedure.

NOTE: Install the fan with the stem of the harness facing towards the front left side.

3.21 Sensor Harnesses

The printer has the following sensor harnesses:

- Paper bail switch/ribbon shift sensor/paper empty switch harness (PB/RS/PE harness)
  [PB/PE harness for those models having no ribbon shift mechanism]
- Forms change switch/head-adjust motor/ribbon shift motor harness (FC/HA/RS harness)
  [FC harness for those models having no automatic head-adjust or ribbon shift mechanism]
- Cut sheet PE switch harness
- Head-adjust motor encoder ASSY (Only for those models equipped with the automatic head-adjust mechanism)

a. Removal

(1) Remove the top cover. (Refer to subsection 3.2.1.)

(2) Pull up the ribbon guide and remove the ribbon cassette.

(3) Remove the body cover. (Refer to Subsection 3.2.1.)

(4) Remove the chassis unit. (Refer to Section 3.3.)

(5) Remove the screws securing the sensor harness to be replaced, by referring to Figures 3.108 and 3.109.

(6) Place the chassis unit upright and take off the harness to be replaced from the corresponding clamp, by referring to Figure 3.110.

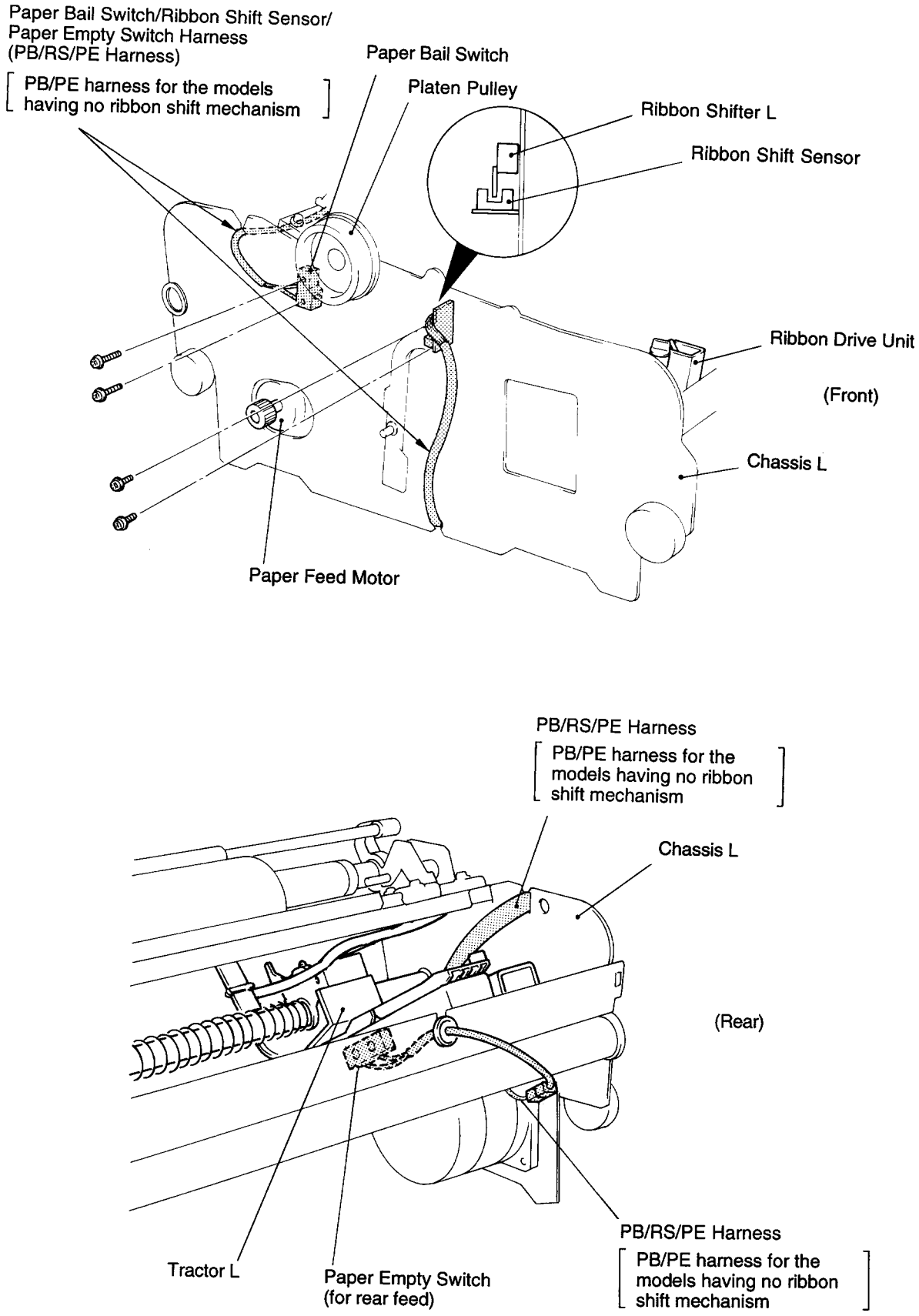


Figure 3.108 Sensor Harnesses on Chassis L

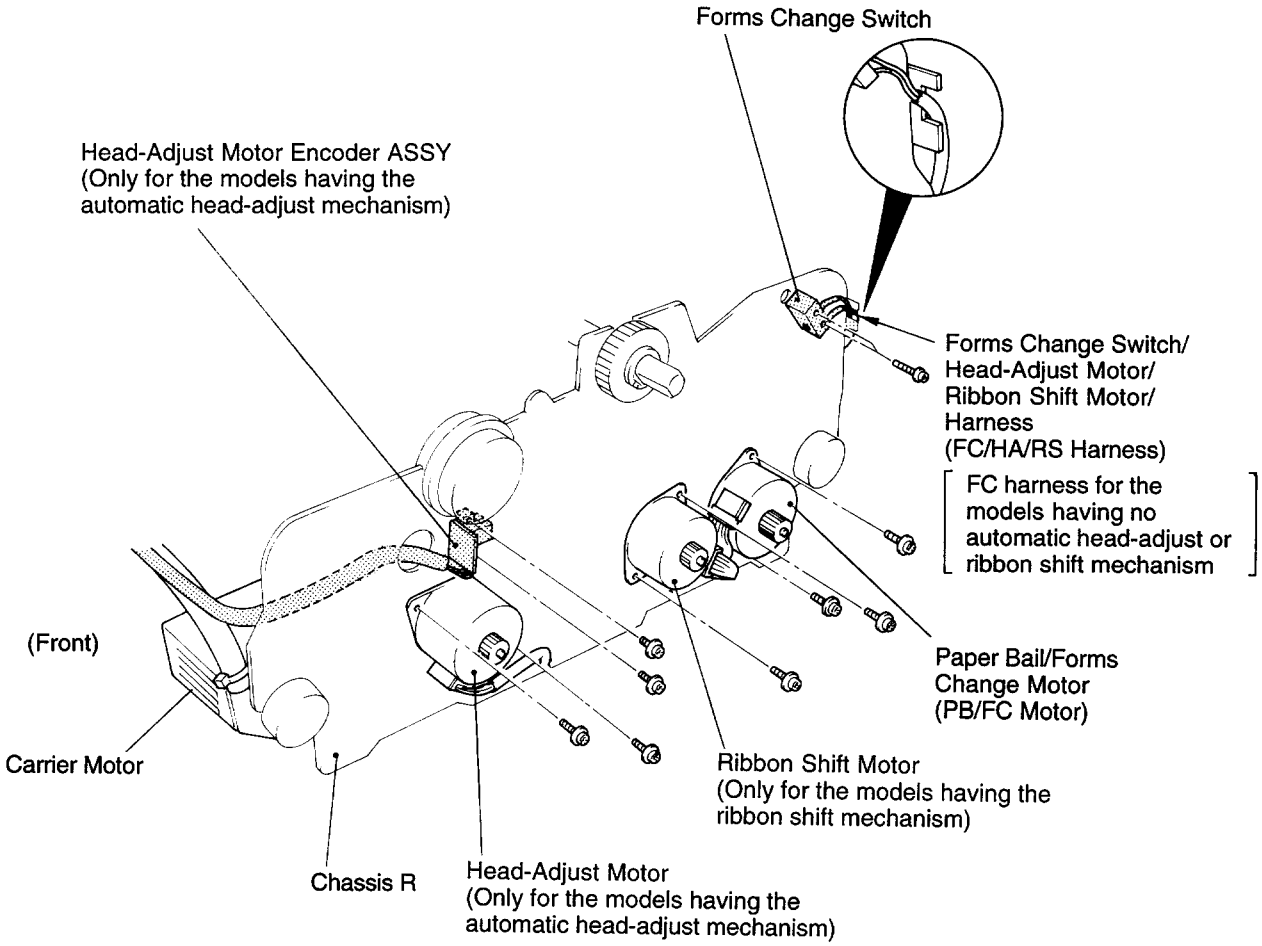


Figure 3.109 Sensor Harnesses on Chassis R

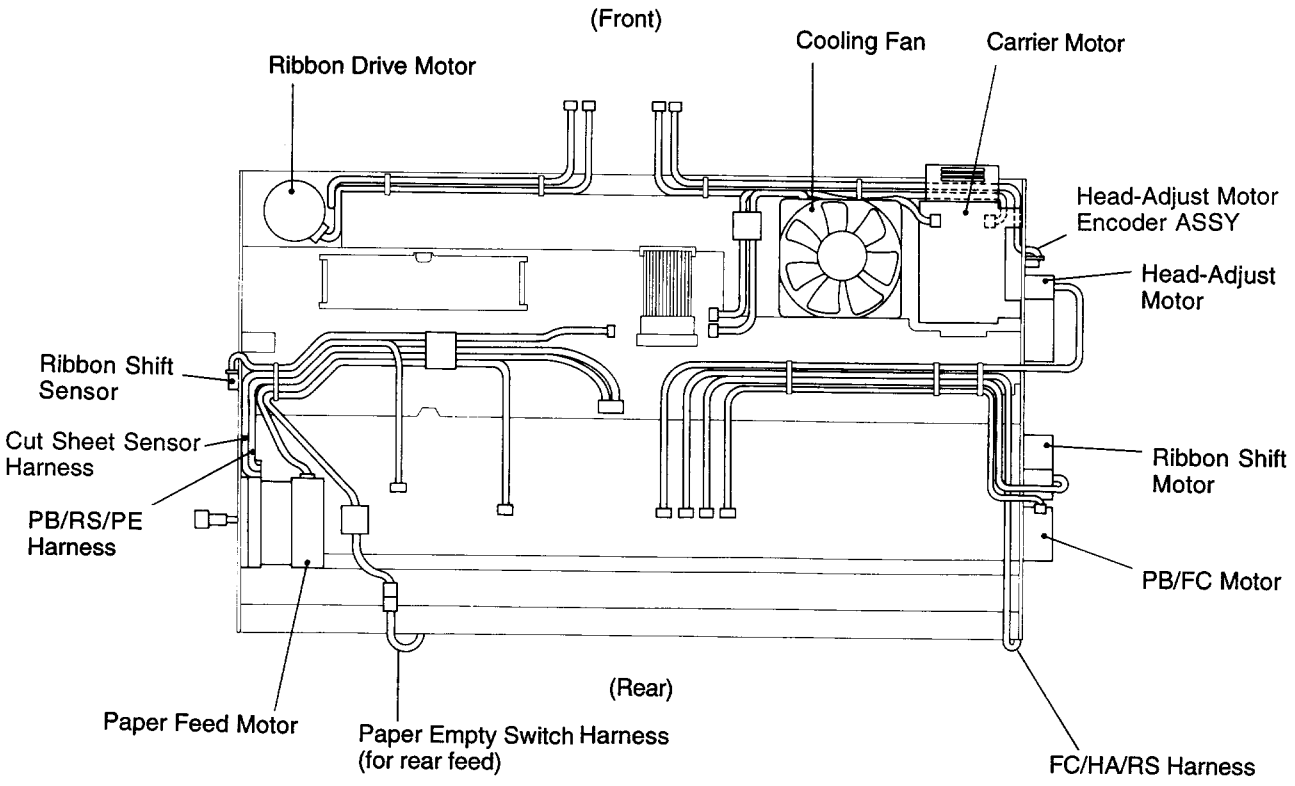


Figure 3.110 (A) Clamping the Sensor Harnesses, as Viewed from the Bottom [Models equipped with automatic head-adjust and ribbon shift mechanisms]

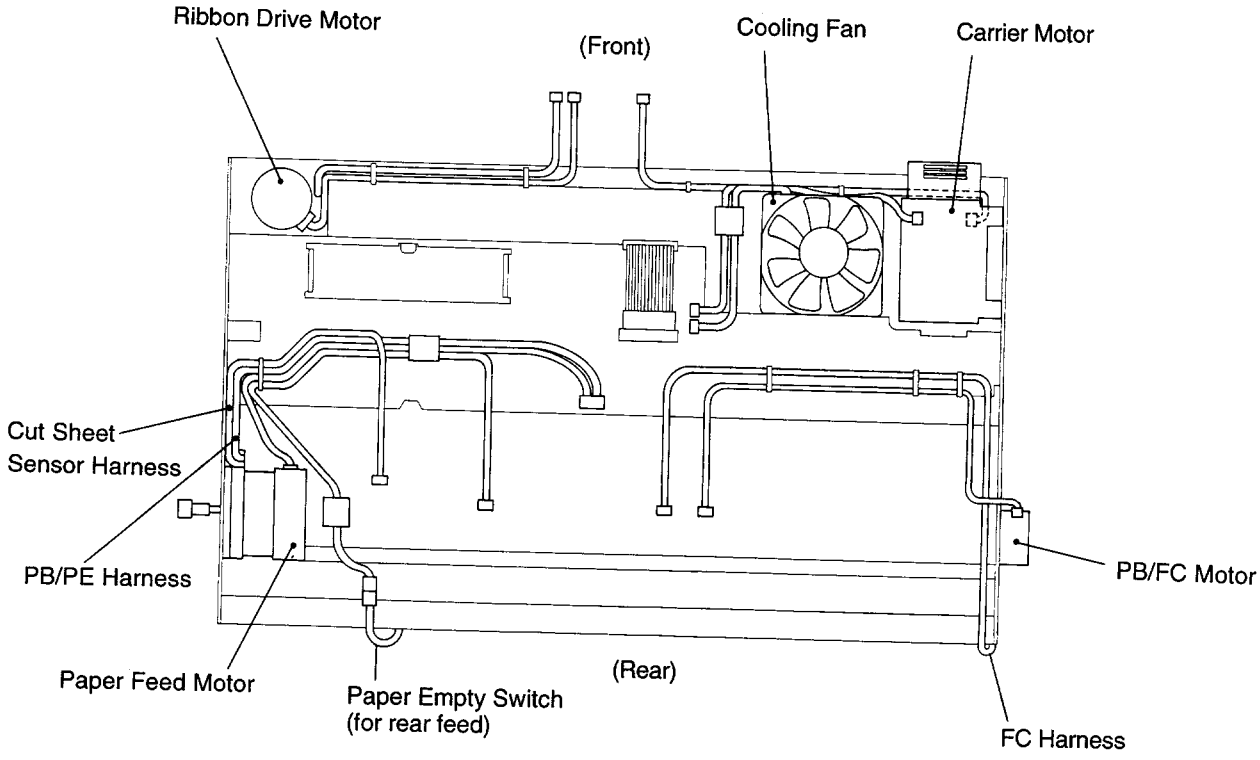


Figure 3.110 (B) Clamping the Sensor Harnesses, as Viewed from the Bottom [Models without automatic head-adjust or ribbon shift mechanism]

b. Installation

Reverse the removal procedure.

NOTE: For the routing of the sensor harnesses, refer to Figures 3.108, 3.109, and 3.110.

4. SERVICE MODES

The Service modes allow the service personnel to make the following adjustments which are essential after the printer undergoes maintenance described in Sections 2 and 3. In the offline Service mode, use the switch panel to access the settings in the EEPROM; in the online mode, enter new settings with commands.

(1) Main PCB setting for the optional mechanisms
(2) Gap between the print head and platen
(3) Paper cutting position
(4) Top-of-form position
(5) Print start position
(6) Vertical character alignment in bidirectional printing
(7) Ribbon shift amount

The above adjustments are required if the EEPROM on the main PCB, the print head, or the platen is replaced or other sections are serviced.

4.1 Offline Service Mode

4.1.1 Entry into the Offline Service Mode

To make the printer enter the Service mode, turn on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

To escape from this mode, turn the POWER switch off and then on.

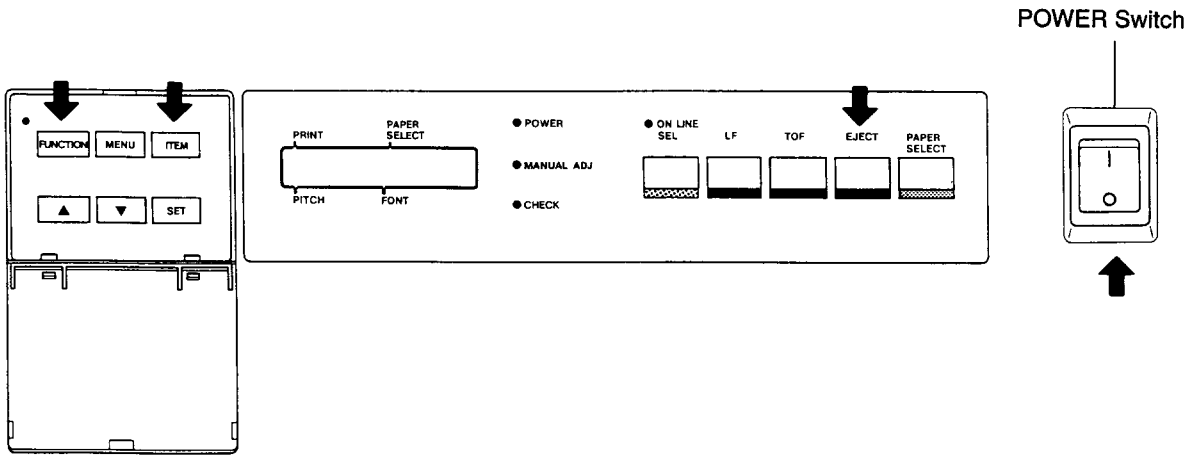


Figure 4.1 Switch Panel and POWER Switch

4.1.2 Detailed Description of Offline Service-mode Facilities

[1] Main PCB setting for the optional mechanisms

If the main PCB is replaced with a new one, match the new main PCB to the printer relating to whether or not the printer is equipped with the automatic head-adjust or ribbon shift mechanism, according to the steps below: (If the EEPROM on the PCB is not replaced, no setting operation below is required.)

(1) Place the printer in the offline Service mode, by turning on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp will flash and the "OPTION SELECT" will appear on the LCD.

(2) Press the ITEM switch.

The "HEAD ADJUST XXX*" will appear on the LCD.

(3) Use the ▲ or ▼ switch to select "YES" if the printer is equipped with the automatic head-adjust mechanism; to select "NO", if no such mechanism.

(4) Press the SET switch to save the new setting into the EEPROM.

(5) Press the ITEM switch.

The "RIBBON SHIFT XXX*" will appear on the LCD.

(6) Use the ▲ or ▼ switch to select "YES" if the printer is equipped with the ribbon shift mechanism; to select "NO", if no such mechanism.

(7) Press the SET switch to save the new setting into the EEPROM.

(8) To escape from the Service mode, turn the POWER switch off and on. To proceed to other adjustments, press the MENU switch.

[2] Gap between the print head and platen

NOTE: In the Service mode as well, the cover switch works to detect a cover-open error. Therefore, insert a flat screwdriver or the like as shown in Figure 4.2 to make the cover switch inoperative during the gap adjustment works from (A) to (D) below.

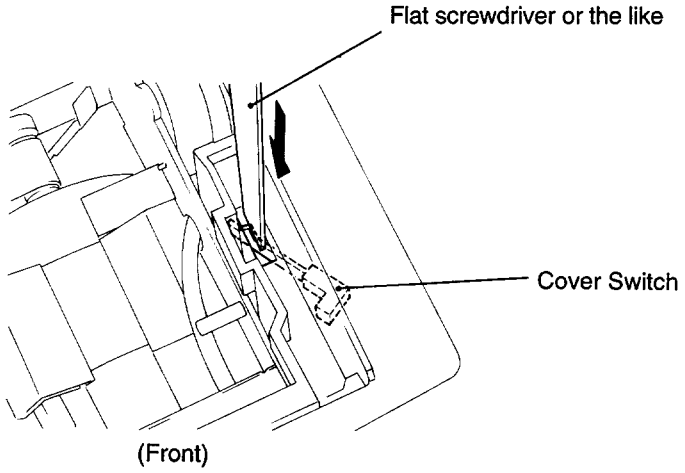


Figure 4.2 Making the Cover Switch Inoperative

NOTE: Before starting the gap adjustment works, make sure that no paper is in the printer. Gap adjustment with paper remaining in the printer will produce an incorrect setting.

(A) Head-platen gap adjustment

If the main PCB*, carrier, carrier sleeve, or automatic head-adjust mechanism is replaced with a new one, adjust the gap between the print head and the platen according to the steps below:

(*If the EEPROM is transferred from the old main PCB onto the new one, no adjustment work below is required.)

(1) Place the printer in the Service mode, by turning on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp will flash and the "OPTION SELECT" will appear on the LCD.

(2) Press the MENU switch.

The "ADJUST HEAD GAP" will appear on the LCD.

(3) Press the ITEM switch.

The "HEAD GAP L = XX*" will appear on the LCD.

(4) Compare the head nose length (L = XX) shown on the LCD with the figure printed on the actual print head.

If the displayed value is different from the actual nose length, use the ▲ or ▼ switch to correct it to the actual value.

(5) Press the SET switch.

(If paper is present in the printer, an ejecting operation takes place according to the current paper load mode and then the print head will be retracted. However, if the paper remains after the ejecting operation, remove the paper by pressing the EJECT switch or rotating the platen knob. Then, press the SET switch again.)

The printer presses the print head against the platen and retracts it according to the standard adjustment value N previously stored in the EEPROM.

The "HEAD GAP N = XXX*" will appear on the LCD.

(6) Use the ▲ or ▼ switch to align position "1" on the manual head-adjust gear with the pointer of the head-adjust scale.

Each time the ▼ switch is pressed, the nominal value N is reduced by one pulse and the print head shifts towards the platen; each time the ▲ switch is pressed, N is added by one pulse and the print head shifts away from the platen.

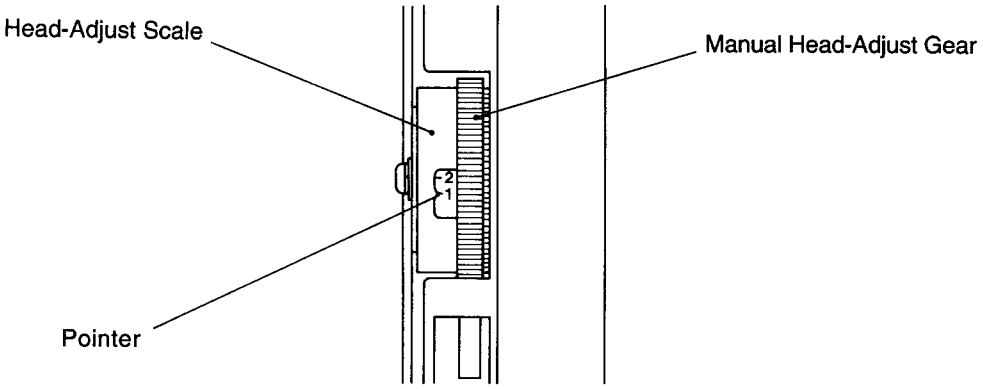


Figure 4.3 Adjusting the Head-adjust Scale

(7) Press the SET switch.

The new nominal value N, head nose length L, number of pulses, and others will be written onto the EEPROM.

(8) To escape from the Service mode, turn the POWER switch off and on. To proceed to other adjustments, press the MENU switch.

(B) Head-platen gap compensation

This compensation work should be carried out in the Function mode, prior to replacing the platen or checking the head-platen gap.

(1) Turn on the POWER switch.

(2) If the printer is online, press the SEL switch to make it offline.

The ON LINE lamp will go off.

(3) Press the EJECT switch to retract or eject paper.

(4) Press the FUNCTION switch.

The FUNCTION lamp will come on.

(5) Press the MENU switch six times.

The "ADJUST HEAD GAP MENU" will appear on the LCD.

(6) Press the ITEM switch.

The "HEAD GAP L = XX*" will appear on the LCD.

(7) Press the SET switch.

(8) To escape from this mode, press the FUNCTION switch.

(C) Platen property compensation

If the platen is replaced with a new one, compensate for the individual difference in platens.

(1) Place the printer in the Service mode, by turning on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp will flash and the "OPTION SELECT" will appear on the LCD.

(2) Press the MENU switch.

The "ADJUST HEAD GAP" will appear on the LCD.

(3) Press the ITEM switch twice.

The „EXCHANGE PLATEN, PUSH SET SW" will appear on the LCD.

(4) Press the SET switch.

The print head will shift to the proper position.

(If paper is present in the printer, an ejecting operation takes place according to the current paper load mode and then the print head will be retracted. However, if the paper remains after the ejecting operation, remove the paper by pressing the EJECT switch or rotating the platen knob. Then, press the SET switch again.)

The "HEAD GAP N = XXX*" will appear on the LCD.

(5) Loosen the screw securing the head-adjust scale and turn the head-adjust scale to make the pointer indicate the "1" position. Then, tighten the screw. (See Figure 4.3.)

(6) To escape from the Service mode, turn the POWER switch off and on. To proceed to other adjustments, press the MENU switch.

(D) Head property compensation

If the print head is replaced with a new one, compensate for the individual difference in print heads in the Function mode.

(1) Turn on the POWER switch.

(2) If the printer is online, press the SEL switch to make it offline.

The ON LINE lamp will go off.

(3) Press the EJECT switch to retract or eject paper.

(4) Press the FUNCTION switch.

The FUNCTION lamp will come on.

(5) Press the MENU switch six times.

The "ADJUST HEAD GAP MENU" will appear on the LCD.

(6) Press the ITEM switch.

The "HEAD GAP L = XX∗" will appear on the LCD.

(7) Use the ▲ or ▼ switch to select the nose length printed on the new print head.

(8) Press the SET switch.

The print head will shift to the proper position.

(9) Loosen the screw securing the head-adjust scale and turn the head-adjust scale to make the pointer indicate the "1" position. Then, tighten the screw. (See Figure 4.3.)

(10) To escape from this mode, press the FUNCTION switch.

[3] Paper cutting position

The procedure below adjusts the paper feed amount for the tear-off position in the continuous FORMS mode in increments of 1/216", in order to align the perforation with the paper cutter. (See Figure 4.4.)

(1) Place the printer in the service mode, by turning on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp will flash and the "OPTION SELECT" will appear on the LCD.

(2) Press the MENU switch twice.

The "ADJUST PAPER CUT POSITION" will appear on the LCD.

(3) Press the ITEM switch once.

The "PAPER CUT POSI. PULSE XXX*" will appear on the LCD.

(4) Set a continuous form on the tractor feeder and press the SET switch.

The printer will automatically feed the paper according to (Nominal value N + current correction parameter P) previously stored in the EEPROM.

($-36 \leq P \leq +36$, Δ = 1/216")

(5) Use the ▲ or ▼ switch to set new correction parameter so that the paper moves to the desired paper cut position.

Each time the ▲ or ▼ switch is pressed, paper shifts by Δ or in increments of 1/216".

This operation sets new correction parameter P'.

(6) Press the SET switch.

The new correction parameter P' will be written onto the EEPROM.

(According to (N + P'), the printer will feed paper when it will be used in the continuous FORMS mode.)

(7) To escape from the Service mode, turn the POWER switch off and on. To proceed to other adjustments, press the MENU switch.

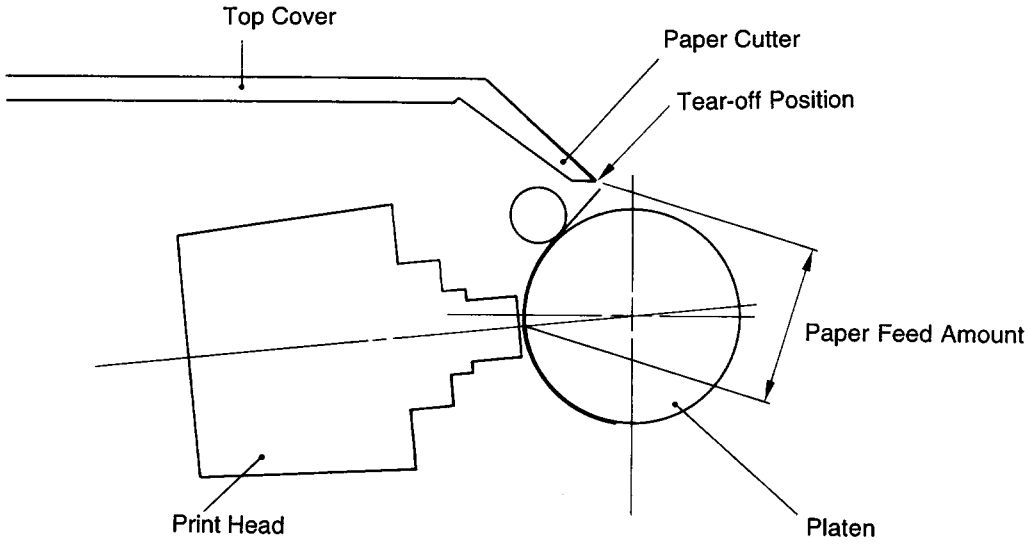


Figure 4.4 Paper Cutting Position

[4] Top-of-form position

The procedure below adjusts the top-of-form position in increments of 1/216".

(1) Place the printer in the Service mode, by turning on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp will flash and the "OPTION SELECT" will appear on the LCD.

(2) Press the MENU switch three times.

The "ADJUST TOF-OF PAPER POSITION" will appear on the LCD.

(3) Use the ITEM switch to select the continuous FORMS or cut SHEET mode.

The "FORMS" or "SHEET/ACSF" will appear on the LCD.

(4) Press the SET switch.

The printer will automatically feed the paper, then print the combinations of correction parameter P and test pattern at eleven levels (for the current position and the preceding and following 5-level positions). Figure 4.5 shows a sample printout based on the current top-of-form position which is determined by (Nominal value N + current correction parameter P). In this case, P = zero.

(-36 ≤ P ≤ +36, Δ = 1/216")

Upon completion of printing, the printer will feed paper to the top-of-form position on the next page in the continuous FORMS mode, or eject the cut sheet in the cut SHEET mode.

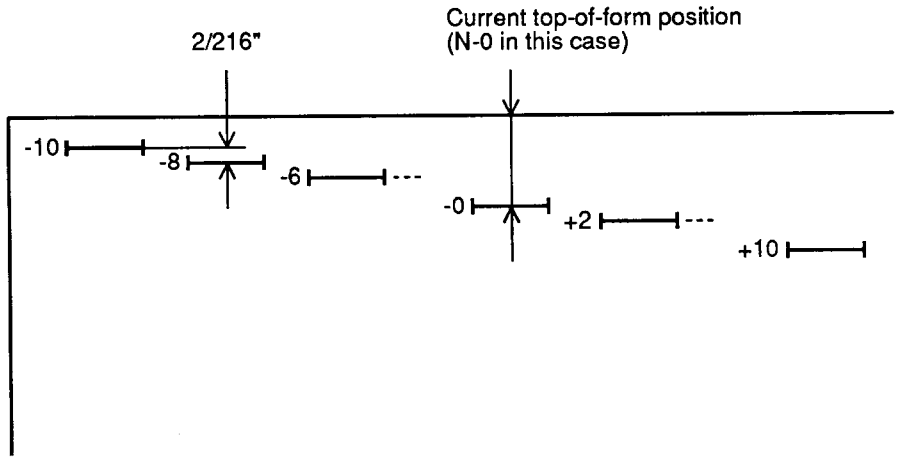


Figure 4.5 Test Patterns for Top-of-form Position Adjustment

(5) Check the printout, then use the ▲ or ▼ switch to set new correction parameter so that the top-of-form position is adjusted to 13/12" or 9/12" for continuous forms or cut sheets, respectively.

The top-of-form position can be adjusted by Δ or in increments of 1/216" although the test patterns are printed in increments of 2/216".)

This operation sets new correction parameter P'.

(6) Press the SET switch.

The new correction parameter P' will be written onto the EEPROM. In the continuous FORMS mode, the printer will once retract paper and then feed it forwards according to (N + P'). In the cut SHEET mode, it will feed a new sheet.

Then, the printer will print the combination of new correction parameter P' and test pattern. In the continuous FORMS mode, the paper will advance to the top-of-form position on the next page; in the cut SHEET mode, the paper will be ejected.

(7) For each of the FORMS, SHEET, and ACSF modes, repeat steps (3) through (6) above.

(8) To proceed to other adjustments, press the MENU switch.

To escape from the Service mode, turn the POWER switch off and on.

[5] Print start position

The procedure below adjusts the print start position in the five character modes: the condensed NLQ, NLQ, 15 cpi, draft, and high-speed draft modes, in increments of 1/720".

(1) Set a continuous form on the tractor feeder.

(2) Place the printer in the Service mode, by turning on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp will flash and the "OPTION SELECT" will appear on the LCD.

(3) Press the MENU switch four times.

The "ADJUST FIRST COLUMN" will appear on the LCD.

(4) Press the ITEM switch to select the proper character pitch.

The "FIRST COLUMN XXX X*" will appear on the LCD.

(5) Press the SET switch.

The printer will print the combinations of the selected character pitch, correction parameter P, and test pattern at eleven levels (for the current position and the preceding and following 5-level positions). Figure 4.6 shows a sample printout based on the current print start position which is determined by (Nominal value N + current correction parameter P). In this case, P = zero.

(-36 ≤ P ≤ +36, Δ = 1/720")

Upon completion of printing, the printer will feed the paper by ten lines.

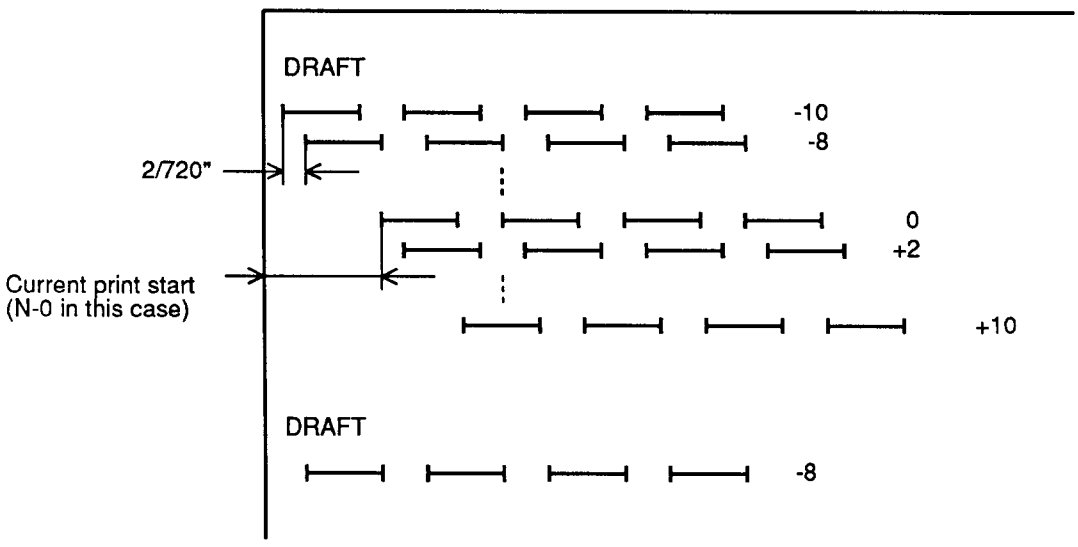


Figure 4.6 Test Patterns for First Print Position Adjustment

(6) Check the printout, then press the ▲ or ▼ switch to select the correction parameter of the test pattern aligning with the leftmost marking on the clear cover. (See Figure 4.6-1.)

The print start position can be adjusted by Δ or in increments of 1/720" although the test patterns are printed in increments of 2/720".)

This operation sets new correction parameter P'.

(7) Press the SET switch.

The new correction parameter P' will be written onto the EEPROM and the printer will print the combination of the selected character pitch, new correction parameter P', and test pattern on the print start position specified by (N + P'). In the continuous FORMS mode, the paper will advance to the top-of-form position on the next page; in the cut SHEET mode, the paper will be ejected.

(8) Repeat steps (4) to (7) four times more to adjust the print start position for each character pitch.

(9) Press the MENU switch to proceed to the vertical alignment described in [6].

To escape from the Service mode, turn the POWER switch off and on.

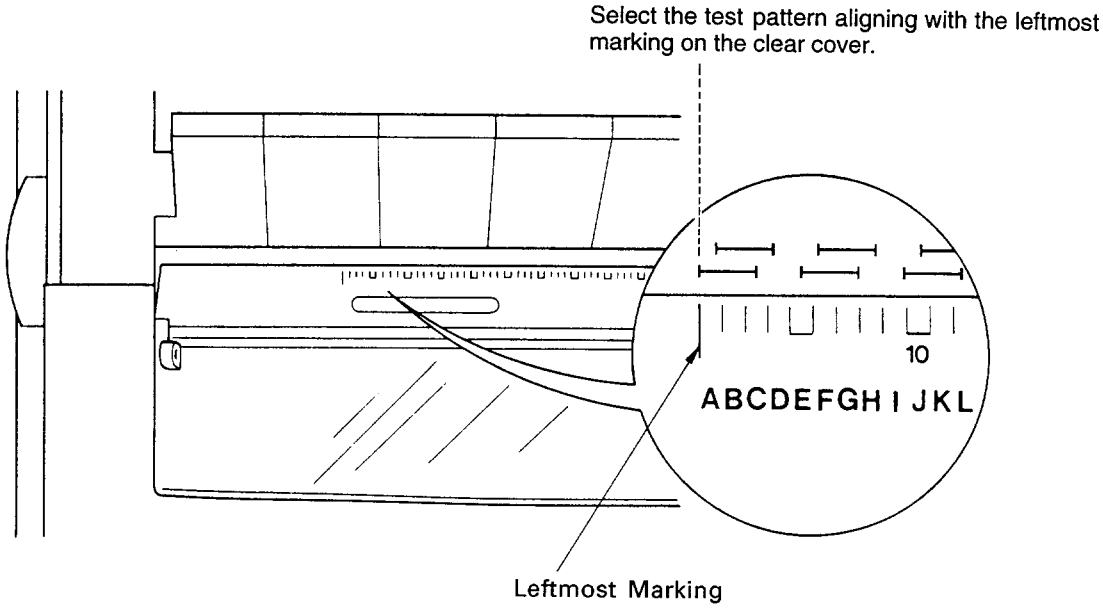


Figure 4.6-1 Test Pattern Aligning with the Leftmost Marking on Clear Cover

[6] Vertical character alignment in bidirectional printing

The procedure below adjusts the vertical alignment of print characters in bidirectional printing in the five character modes: the condensed NLQ, NLQ, 15 cpi, draft, and high-speed draft modes, in increments of 1/720".

(1) Set a continuous form on the tractor feeder.

(2) Place the printer in the service mode, by turning on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp will flash and the "OPTION SELECT" will appear on the LCD.

(3) Press the MENU switch five times.

The "ADJUST VERTICAL ALIGNMENT" will appear on the LCD.

(4) Press the ITEM switch to select the character pitch.

The "V. ALIGNMENT XXX X*" will appear on the LCD.

(5) Press the SET switch.

The printer will print the combinations of the selected character pitch, correction parameter P, and test pattern at eleven levels (for the current position and the preceding and following 5-level positions). Figure 4.7 shows a sample printout based on the current alignment position which is determined by (Nominal value N + current correction parameter P). In this case, P = zero.

(-36 ≤ P ≤ +36, Δ = 1/720")

Upon completion of printing, the printer will feed the paper by ten lines.

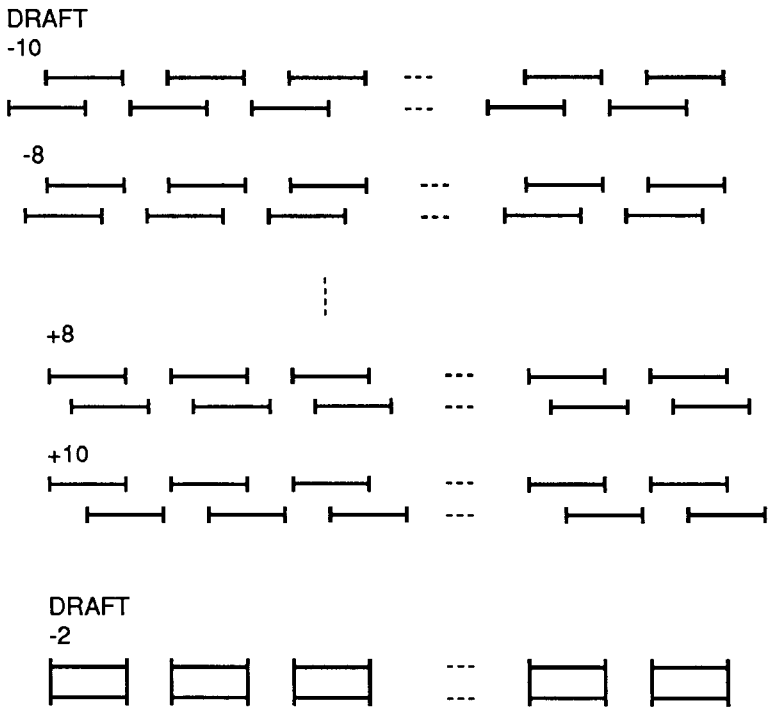


Figure 4.7 Test Patterns for Vertical Character Alignment

(6) Check the printout, then press the ▲ or ▼ switch to select the correction parameter of the test patterns vertically aligned.

The print alignment position can be adjusted by Δ or in increments of 1/720" although the test patterns are printed in increments of 2/720".

This operation sets new correction parameter P'.

(7) Press the SET switch.

The new correction parameter P' will be written onto the EEPROM and the printer will print the combination of the selected character pitch, new correction parameter P', and test pattern bidirectionally according to (N + P'). In the continuous FORMS mode, the paper will advance to the top-of-form position on the next page; in the cut SHEET mode, the paper will be ejected.

(8) Repeat steps (4) to (7) four more times to adjust the vertical alignment of print characters for each character pitch.

NOTE: In the High-speed Draft mode, test patterns might not be vertically aligned perfectly. Make the off-alignment as less as possible at the right, left and center of the carrier travel.

(9) To escape from the Service mode, turn the POWER switch off and on. To proceed to other adjustments, press the MENU switch.

[7] Ribbon shift amount

The procedure below adjusts the ribbon shift amount in increments of 1/169" for clear color printing.

(1) Set a continuous form on the tractor feeder.

(2) Set the color ribbon cassette.

(3) Place the printer in the service mode, by turning on the POWER switch while holding down the FUNCTION, ITEM, and EJECT switches.

The FUNCTION lamp will flash and the "OPTION SELECT" will appear on the LCD.

(4) . Press the MENU switch six times.

The "ADJUST COLOR RIBBON POSITION" will appear on the LCD.

(5) Press the ITEM switch.

The "RIBBON POSITION PULSE XX∗" will appear on the LCD.

(6) Press the SET switch.

The printer will print the combinations of correction parameter P and test pattern at eleven levels (for the current shift amount and the preceding and following 5-level amounts). Figure 4.8 shows a sample printout based on the current shift amount which is determined by (Nominal value N + current correction parameter P). In this case, P = +47.

(+30 ≤ P ≤ +60, Δ = 1/169")

Upon completion of color printing, the printer will feed paper by ten lines.

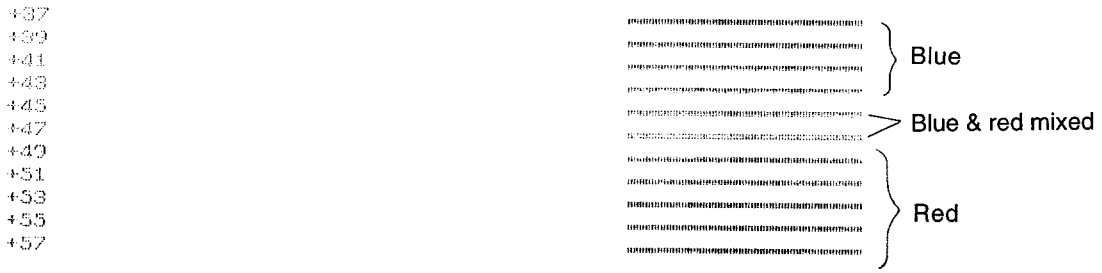


Figure 4.8 Test Patterns for Ribbon Shift Amount

(7) Check the printout, then press the ▲ or ▼ switch to select the correction parameter of the test pattern mixing blue and red.

The ribbon shift amount can be adjusted by Δ or in increments of 1/169" although the test patterns are printed in increments of 2/169".)

(8) Press the SET switch.

The new correction parameter P' will be written onto the EEPROM, then the printer will shift the ink ribbon according to (N + P') and print the combination of new correction parameter P' and test pattern. In the continuous FORMS, the paper will advance to the top-of-form position on the next page; in the cut SHEET mode, the paper will be ejected.

(9) To escape from the Service mode, turn the POWER switch off and on. To proceed to other adjustments, press the MENU switch.

4.2 Online Service Mode

4.2.1 Entry into the Online Service Mode

To make the printer enter the service mode, turn on the POWER switch while holding down the FUNCTION, ITEM, and PAPER SELECT switches.

To escape this mode, turn the POWER switch off and then on.

The table below lists the command formats:

C P1 P2 CR (0DH)

C: Adjustment code
P1, P2: Parameters

	Adjustment items	Command format
(1)	Optional feature setting	89H P1 P2 CR
(2)	Head-platen gap	85H P1 P2 CR
(3)	Paper cutting position	87H P1 CR
(4)	Top-of-form position	81H P1 P2 CR
(5)	Print start position	88H P1 P2 CR
(6)	Vertical character alignment in bidirectional printing	80H P1 P2 CR
(7)	Ribbon shift amount	86H P1 CR
(8)	Emulation selection	82H P1 CR
(9)	Scandinavian CG	83H P1 CR
(10)	Format selection	84H P1 CR

4.2.2 Detailed Description of Online Service-mode Facilities

[1] Main PCB setting for the optional mechanisms 89H P1 P2 CR

P1: Selects the option type.
- 00H: Automatic head-adjust mechanism
- 01H: Ribbon shift mechanism

P2: Activates or deactivates the optional facility.
- 00H: Deactivates
- 01H: Activates

Upon receipt of a CR code following P2, the printer saves the setting values specified by parameters P1 and P2 into the EEPROM.

[2] Head-platen gap adjustment 85H P1 P2 CR

P1: Selects the adjustment mode.

00H: Carries out the preparatory adjustment operation according to the head nose length specified by P2.

That is, upon receipt of a CR code following P2, the printer automatically retracts the print head, presses it against the platen to measure the number of pulses M1 from the initial position, then retracts the head by 130 pulses.

(If paper is present in the printer when a CR code is received, an ejecting operation takes place according to the current paper load mode and then the print head will be retracted. However, if paper persists after the ejecting operation, no head retraction sequence will result.)

01H: Upon receipt of a CR code, the printer shifts the print head towards the platen or away from the platen by one pulse, according to P2. At the same time, nominal value N previously stored in the EEPROM will be reduced or added.

02H: Completes the head-platen gap adjustment.

Upon receipt of a CR code, new nominal value N, head nose length L, number of pulses M1, and excited phase F of the motor at M1 position will be written onto the EEPROM.

P2:

When P1 = 00H,

MSB LSB

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Bits 1 to 5: Head nose length
Bits 6 to 8: Ignored

When P1 = 01H,

00H: Shifts the head towards the platen by one pulse.

01H: Retracts the head from the platen by one pulse.

When P1 = 02H,

This command will be interpreted as an invalid parameter and ignored.

[3] Paper cutting position

87H P1 CR

P1: Sets correction value P (-36 ≤ P ≤ +36). (Δ = 1/216")

MSB LSB

□ □ □ □ □ □ □ □

Bits 1 to 6:	Absolute value	
Bit 7:	Sign bit	0: +
		1: −
Bit 8:	Invalid	

Upon receipt of a CR code following P1, the printer feeds paper according to (Nominal value N + correction parameter P specified by P1), as well as writing P onto the EEPROM.

[4] Top-of-form position

81H P1 P2 CR

P1: Selects the paper loading mode.

00H: Continuous FORMS mode

01H: Cut SHEET mode

P2: Sets correction parameter P (-36 ≤ P ≤ +36). (Δ = 1/216")

MSB LSB

□ □ □ □ □ □ □ □

Bits 1 to 6:	Absolute value of correction parameter	
Bit 7:	Sign bit	0: +
		1: −
Bit 8: 0	Writes the correction parameter onto the EEPROM as well as printing it with the test pattern.	
1	Prints not only the current correction parameter but also the preceding and following parameters, as well as printing those test patterns.	

When MSB of P2 = 0,

upon receipt of a CR code, the printer shifts to the paper loading mode specified by P1, feeds paper according to (Nominal value N + P), and prints the combination of the correction parameter P and test pattern, as well as writing P onto the EEPROM.

When MSB of P2 = 1,

upon receipt of a CR code, the printer shifts to the paper loading mode specified by P1, feeds paper according to (Nominal value N + P), and prints the combinations of correction parameter P and test pattern at eleven levels (for the current position and the preceding and following 5-level positions). (Refer to Figure 4.5.)

In the continuous FORMS mode, the paper will advance to the top-of-form position on the next page; in the cut SHEET mode, the paper will be ejected.

[5] Print start position 88H P1 P2 CR

P1: Selects the character pitch.

00H: Draft mode (60 cpi)

01H: NLQ mode (30 cpi)

02H: Condensed NLQ mode (40 cpi)

03H: High-speed draft mode (80 cpi)

04H: 15 cpi mode

P2: Set correction parameter P (-32 ≤ P ≤ +32). (Δ = 1/720")

MSB LSB

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Bits 1 to 6:		Absolute value of correction parameter
Bit 7:		Sign bit 0: + 1: −
Bit 8:	0	Writes the correction parameter onto the EEPROM as well as printing it with the test pattern.
	1	Prints not only the current correction parameter but also the preceding and following parameters, as well as printing those test patterns.

When MSB of P2 = 0,

upon receipt of a CR code, the printer prints the combination of the character pitch selected by P1, correction parameter P and test pattern on the print start position specified by (Nominal value N + P) in the forward direction, as well as writing P onto the EEPROM.

When MSB of P2 = 1,

upon receipt of a CR code, the printer prints the combinations of the character pitch selected by P1, correction parameter P and test pattern at eleven levels (for the current position and the preceding and following 5-level positions) according to (N + P). (Refer to Figure 4.6.)

In the continuous FORMS mode, the paper will advance to the top-of-form position on the next page; in the cut SHEET mode, the paper will be ejected.

[6] Vertical character alignment in bidirectional printing 80H P1 P2 CR

P1: Selects the character pitch.

00H: Draft mode (60 cpi)
01H: NLQ mode (30 cpi)
02H: Condensed NLQ mode (40 cpi)
03H: High-speed draft mode (80 cpi)
04H: 15 cpi mode

P2: Set correction parameter P (-36 ≤ P ≤ +36). (Δ = 1/720")

MSB LSB
□ □ □ □ □ □ □ □

Bits 1 to 6:		Absolute value of correction parameter
Bit 7:		Sign bit 0: + 1: −
Bit 8:	0	Writes the correction parameter onto the EEPROM as well as printing it with the test pattern.
	1	Prints not only the current correction parameter but also the preceding and following parameters, as well as printing those test patterns.

When MSB of P2 = 0,

upon receipt of a CR code, the printer prints the combination of the character pitch selected by P1, the current correction parameter P and the test pattern bidirectionally on a couple of lines according to (Nominal value N + P), as well as writing P onto the EEPROM.

When MSB of P2 = 1,

upon receipt of a CR code, the printer prints the combinations of the character pitch selected by P1, the correction parameter P and test pattern at eleven levels (for the current position and the preceding and following 5-level positions) according to (N + P). (Refer to Figure 4.7.)

In the continuous FORMS mode, the paper will advance to the top-of-form position on the next page; in the cut SHEET mode, the paper will be ejected.

[7] Ribbon shift amount

86H P1 CR

P1: Sets correction parameter P (+30 ≤ P ≤ +60). (Δ = 1/169")

MSB LSB

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Bits 1 to 6:		Absolute value of correction parameter
Bit 7:		Sign bit 0: + 1: –
Bit 8:	0	Writes the correction parameter onto the EEPROM as well as printing it with the test pattern.
	1	Prints not only the current correction parameter with the test pattern but also the preceding and following parameters, as well as printing those test patterns.

When MSB of P1 = 0,

upon receipt of a CR code, the printer shifts the ink ribbon according to (Nominal value N + correction parameter P) and prints the combination of correction parameter P and test pattern in the forward direction, as well as writing P onto the EEPROM.

When MSB of P1 = 1,

upon receipt of a CR code, the printer prints the combinations of the correction parameter P and test pattern at eleven levels (for the current shift amount and the preceding and following 5-level amounts) while shifting the ink ribbon according to (N + P). (Refer to Figure 4.8.)

In the continuous FORMS mode, the paper will advance to the top-of-form position on the next page; in the cut SHEET mode, the paper will be ejected.

[8] Emulation mode selection 82H P1 CR

P1: Selects the emulation mode.

00H: IBM-emulation mode

01H: Epson-emulation mode

Upon receipt of a CR code following P1, the printer saves the setting values specified by parameter P1 into the EEPROM.

[9] Scandinavian or standard CG 83H P1 CR

P1: Selects the Scandinavian or standard CG.

00H: Standard CG

01H: Scandinavian CG

Upon receipt of a CR code following P1, the printer saves the setting values specified by parameter P1 into the EEPROM.

[10] Page length setting 84H P1 CR

P1: Selects the page length.

00H: 11"

01H: 12"

Upon receipt of a CR code following P1, the printer saves the setting values specified by parameter P1 into the EEPROM.

5. HOW TO REMOVE PAPER JAM

If a paper jam occurs, remove it according to the steps below:

NOTE: When it is necessary to switch between the continuous forms and cut sheet modes during the jam removal procedure below, refer to the "Manual Switching between Continuous Forms and Cut Sheet Modes" described on the next page.

(1) Turn off the POWER switch and unplug the power cord from the printer.

(2) Tear off the top and bottom edges of the jammed page along the nearest perforation.

(3) Remove the top cover, ribbon cassette, and rear cover. (Refer to Subsection 3.2.1.)

(4) Open the tractor doors.

(5) While lightly pulling the paper towards the rear, turn the platen knob slowly in the reverse direction to take out the paper.

(6) If any pieces of paper remain in the printer, move the tractors to the end of their travel and remove those pieces towards the rear with your fingers or with tweezers.

If any pieces of paper remain on the pin wheels of the tractors, slowly turn the platen knob in the forward direction to gather those pieces to the front. Then, pull the paper feed spring towards the front and take out those pieces with the ruler, plain plate, or tweezers, as shown in Figure 5.1.

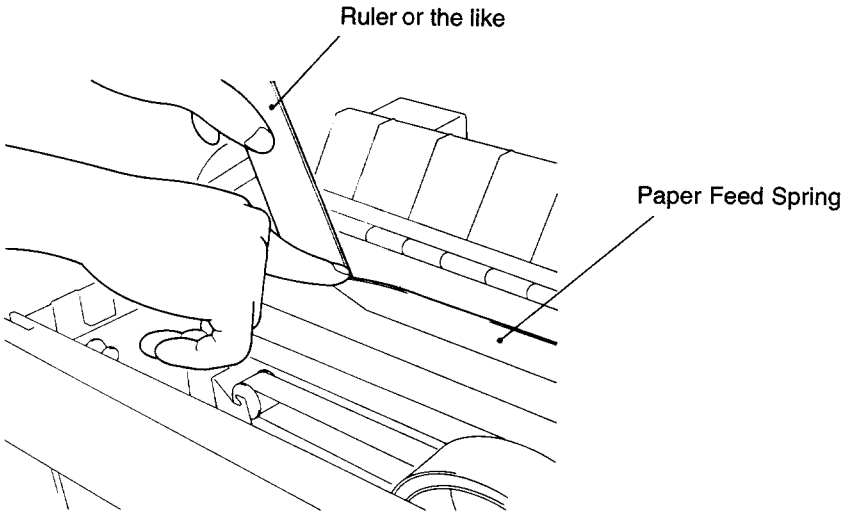


Figure 5.1 Removing Pieces of Paper from Pin Wheels

If any pieces of paper stick to the pin wheels, insert a postcard or paper with the same thickness into the pin wheels as illustrated in Figure 5.2 and slowly turn the platen knob in the forward direction. Take care not to let the postcard come in contact with the print head.

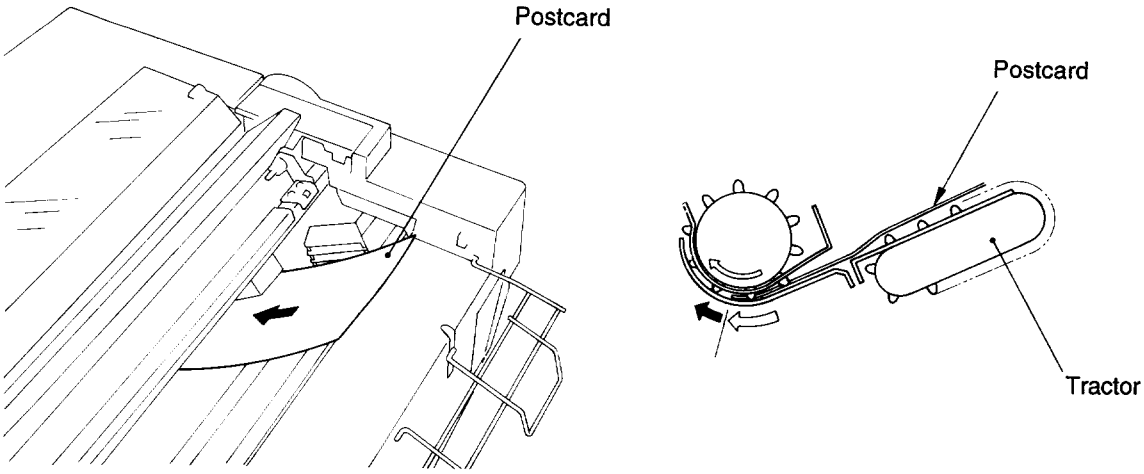


Figure 5.2 Using a Postcard to Remove Pieces of Paper

(7) Install the rear cover, ribbon cassette, and top cover.

"Manual Switching between Continuous Forms and Cut Sheet Modes"

(1) Turn off the POWER switch.

(2) Open the rear cover.

(3) Turn the forms change lever to the desired position. (See Figure 5.3.)

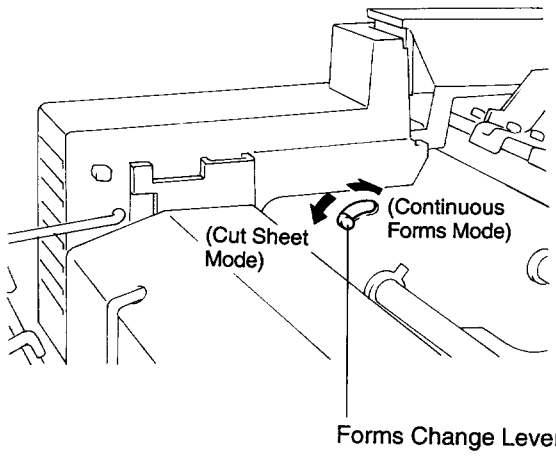


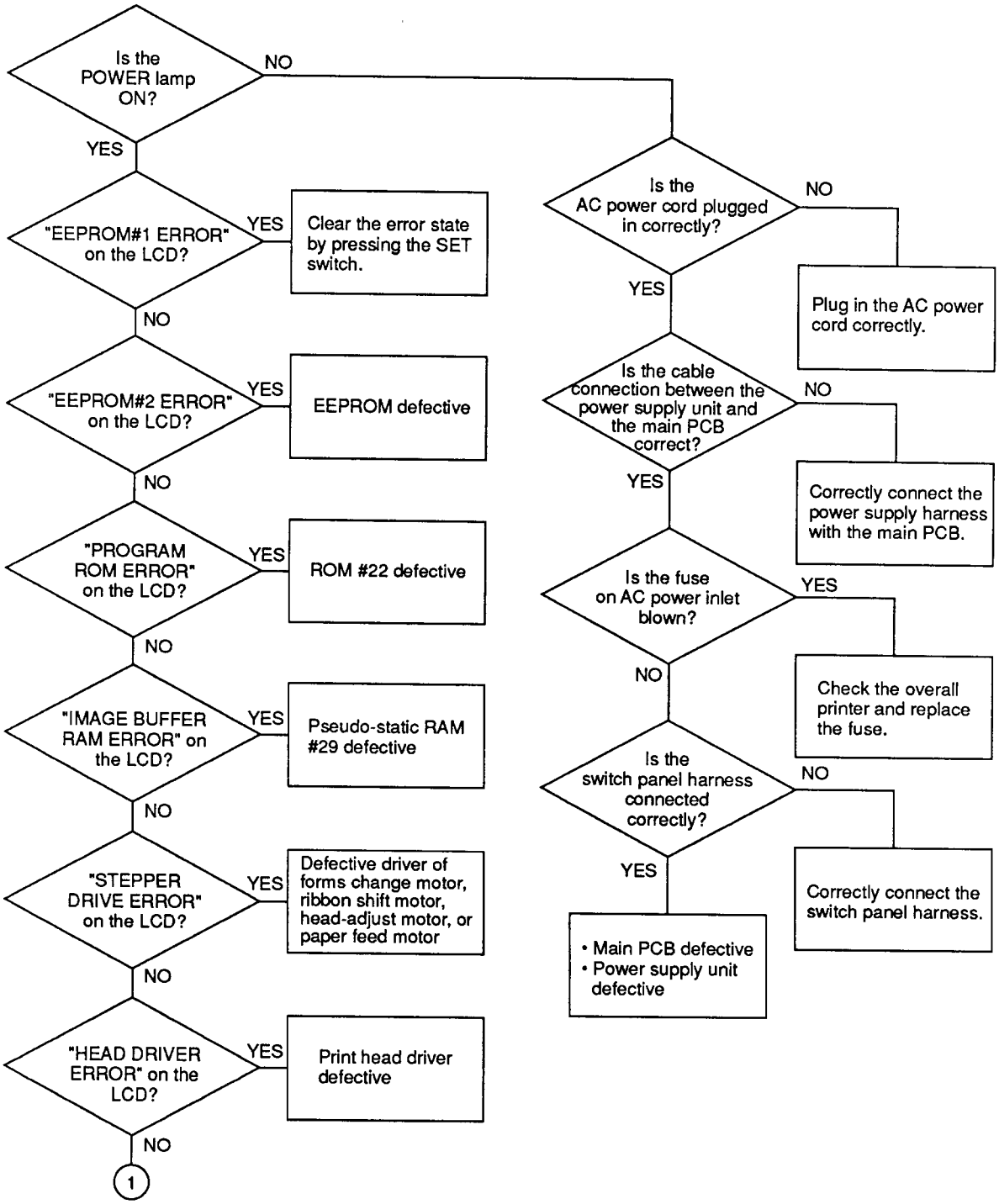
Figure 5.3 Forms Change Lever for Manual Switching

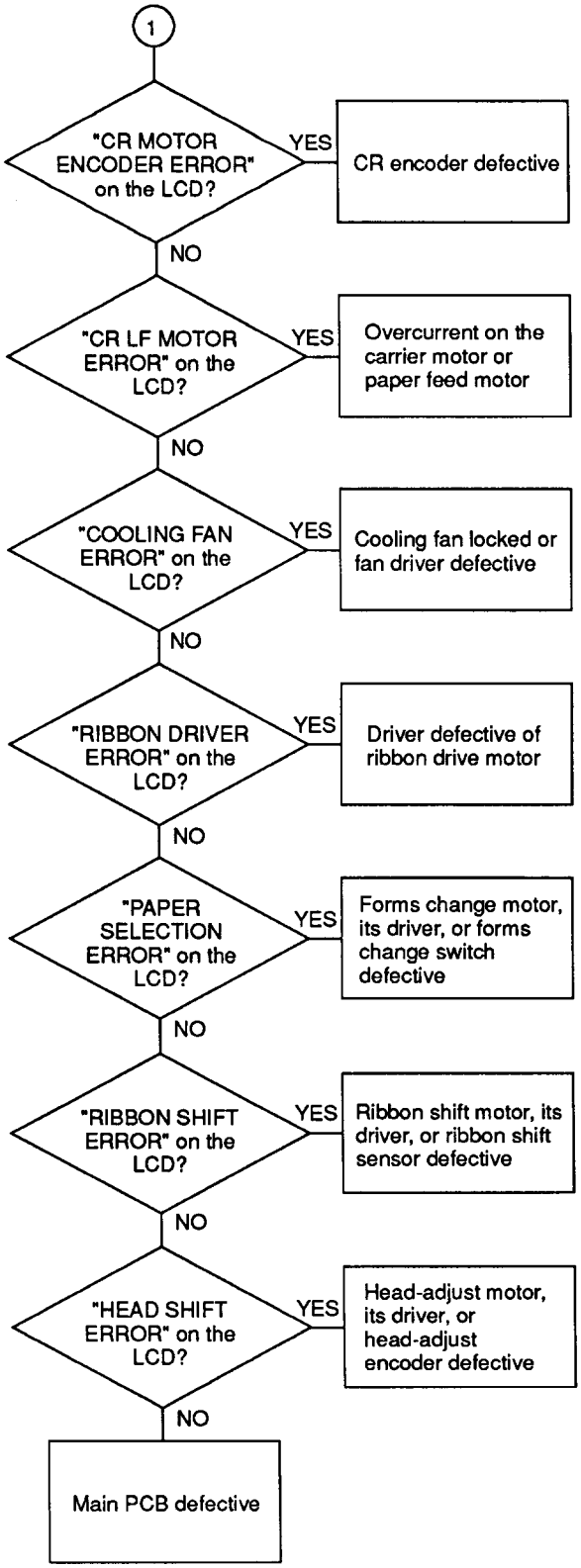
CHAPTER IV.
TROUBLESHOOTING

CONTENTS

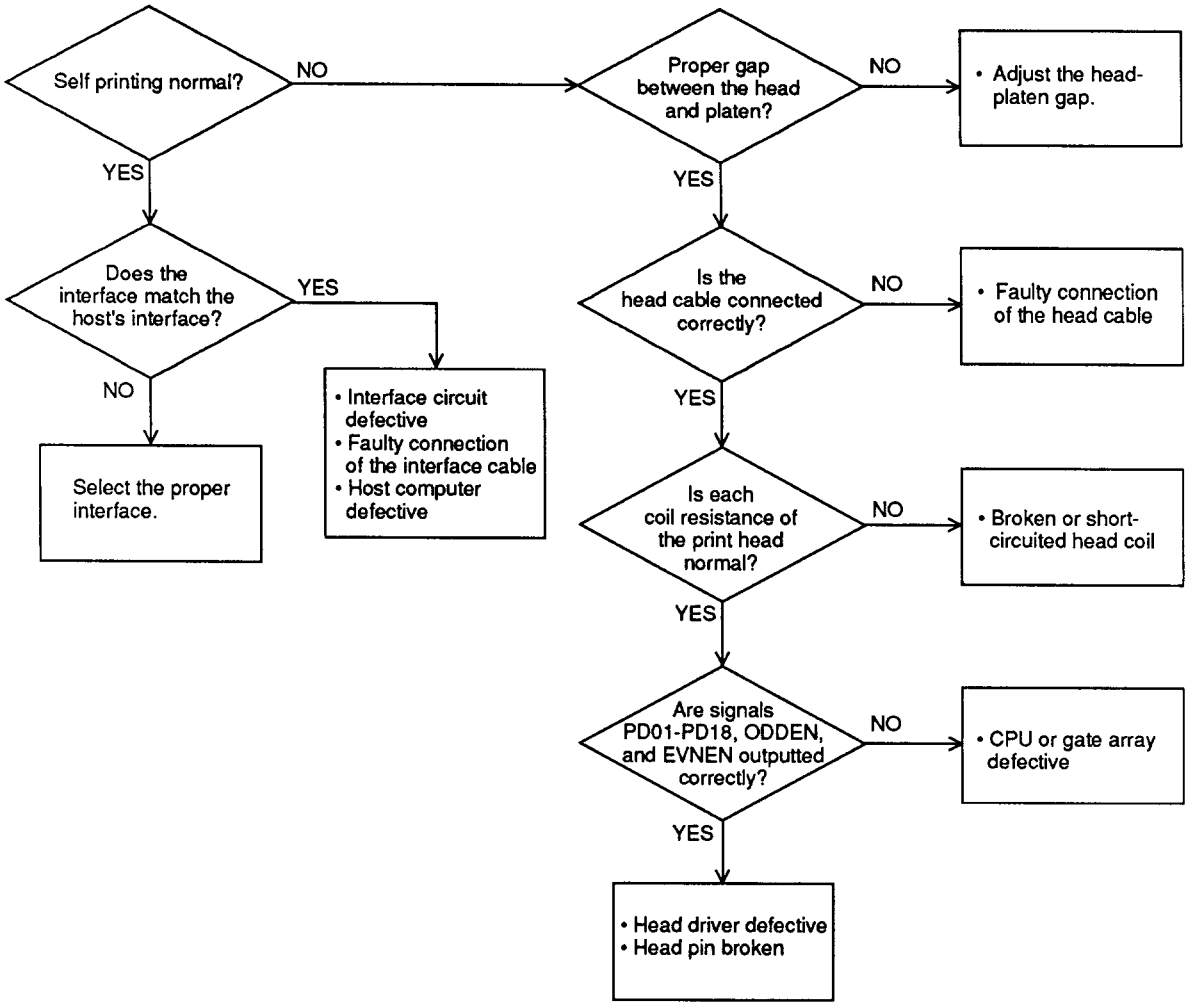
1. When the POWER switch is turned ON, no initializing operation occurs. IV-1
2. Abnormal printing. IV-3
3. Abnormal carrier movement. IV-4
4. Other error indications. IV-5

1. When the POWER switch is turned ON, no initializing operation occurs.

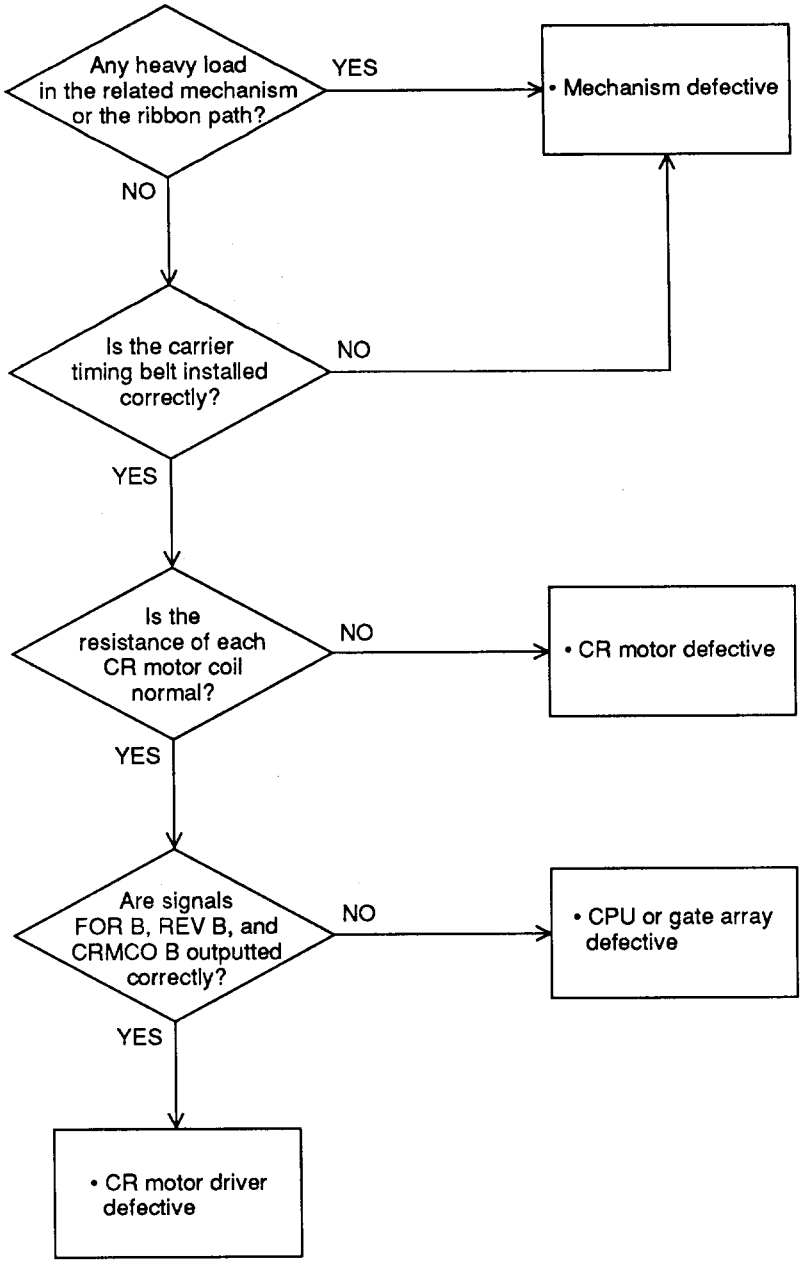



1
"CR MOTOR ENCODER ERROR" on the LCD?
YES
CR encoder defective
NO
"CR LF MOTOR ERROR" on the LCD?
YES
Overcurrent on the carrier motor or paper feed motor
NO
"COOLING FAN ERROR" on the LCD?
YES
Cooling fan locked or fan driver defective
NO
"RIBBON DRIVER ERROR" on the LCD?
YES
Driver defective of ribbon drive motor
NO
"PAPER SELECTION ERROR" on the LCD?
YES
Forms change motor, its driver, or forms change switch defective
NO
"RIBBON SHIFT ERROR" on the LCD?
YES
Ribbon shift motor, its driver, or ribbon shift sensor defective
NO
"HEAD SHIFT ERROR" on the LCD?
YES
Head-adjust motor, its driver, or head-adjust encoder defective
NO
Main PCB defective

2. Abnormal printing.



3. Abnormal carrier movement.


Any heavy load in the related mechanism or the ribbon path?
YES
• Mechanism defective
NO
Is the carrier timing belt installed correctly?
NO
YES
Is the resistance of each CR motor coil normal?
NO
• CR motor defective
YES
Are signals FOR B, REV B, and CRMCO B outputted correctly?
NO
• CPU or gate array defective
YES
• CR motor driver defective

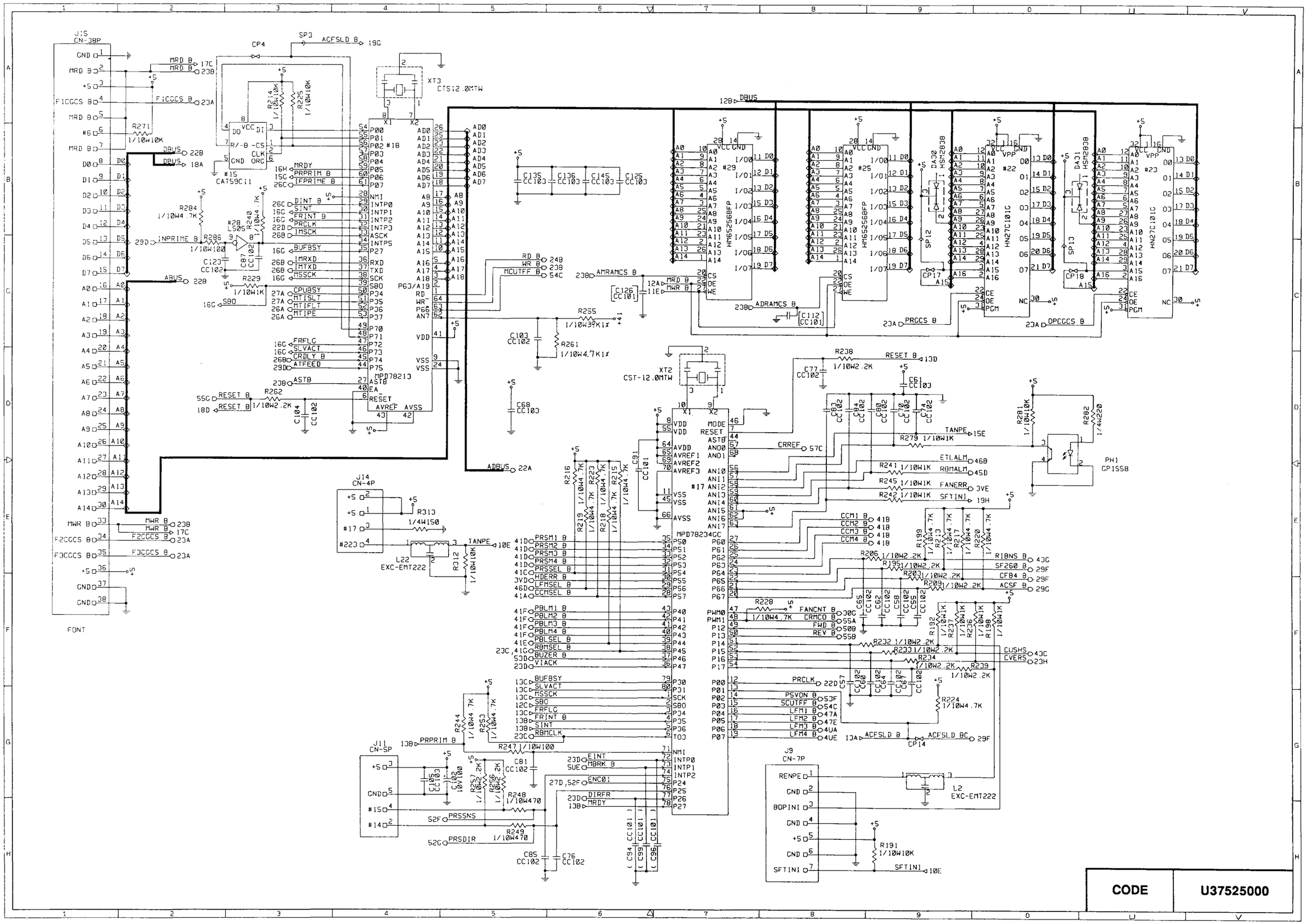
4. Other error indications.

Error Indication on the LCD	Probable Error Factors
PAPER EMPTY FORMS ERROR PAPER EMPTY SHEET ERROR PAPER EMPTY BOTTOM ERROR	• No paper is loaded in the printer. • The corresponding paper empty sensor is defective.
PAPER SELECTION ERROR	• The paper mode setting selected with the PAPER SELECT switch is discrepant with the paper empty sensor in operation.
PAPER EJECT ERROR	• Paper has been jammed.
COVER OPEN ERROR	• The top cover is open or not installed properly. • The cover switch connector is not connected to the switch panel PCB.
IMAGE D/L RAM ERROR	• The pseudo-static RAM #25 is defective.
INPUT BUFFER RAM ERROR	• The pseudo-static RAM #11 is defective.
CG ROM ERROR	• The CG ROM #23 is defective.
I/F ROM RAM ERROR	• The interface CPU is defective.
COMMUNICATION ERROR	• Communications between the main and slave CPUs is abnormal.
SLAVE CPU ERROR	• The slave CPU is defective.
FRAME WIDTH ERROR	• The frame width is abnormal.
CARRIAGE SPEED ERROR	• The carrier motor speed is abnormal.

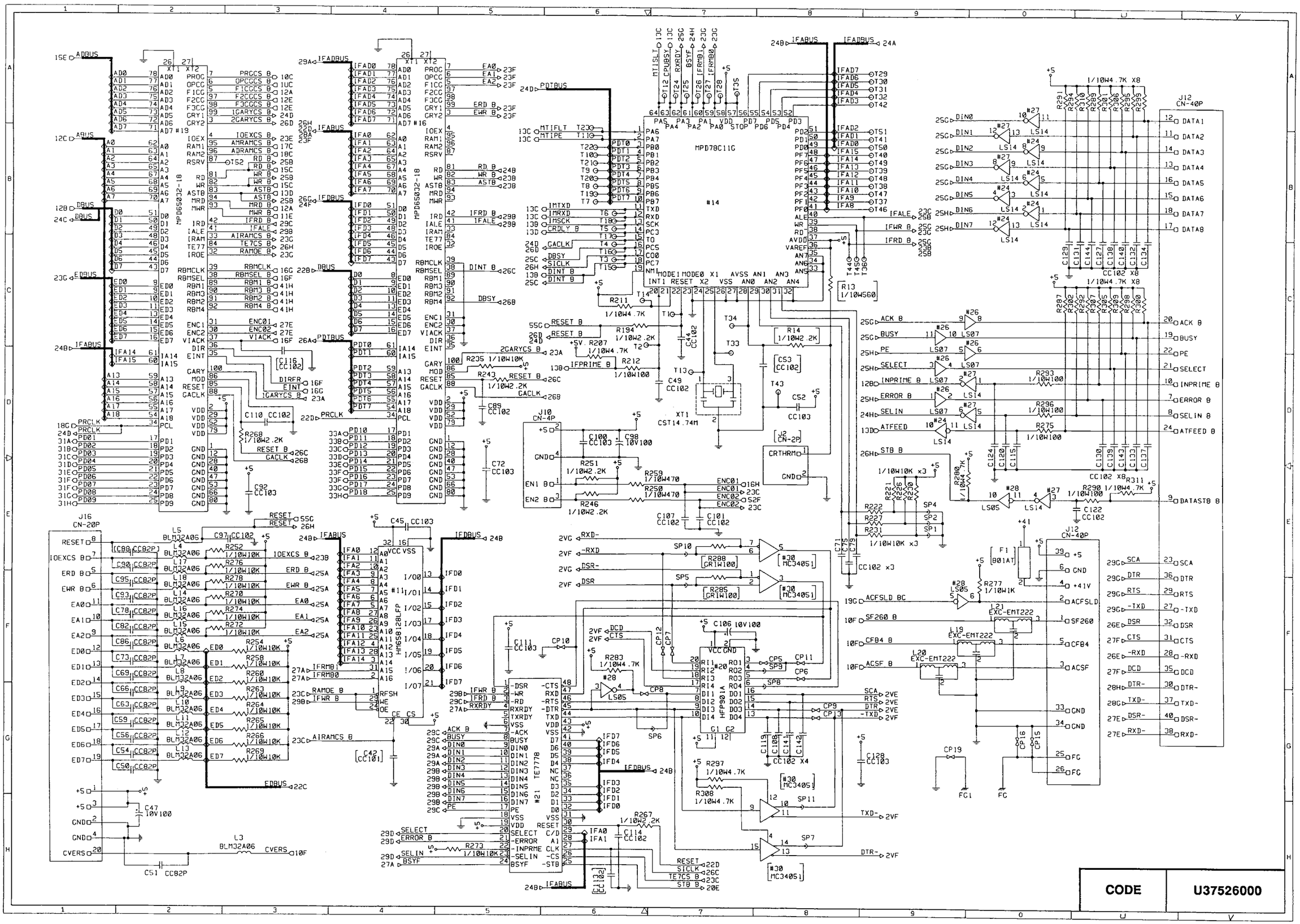
APPENDICES

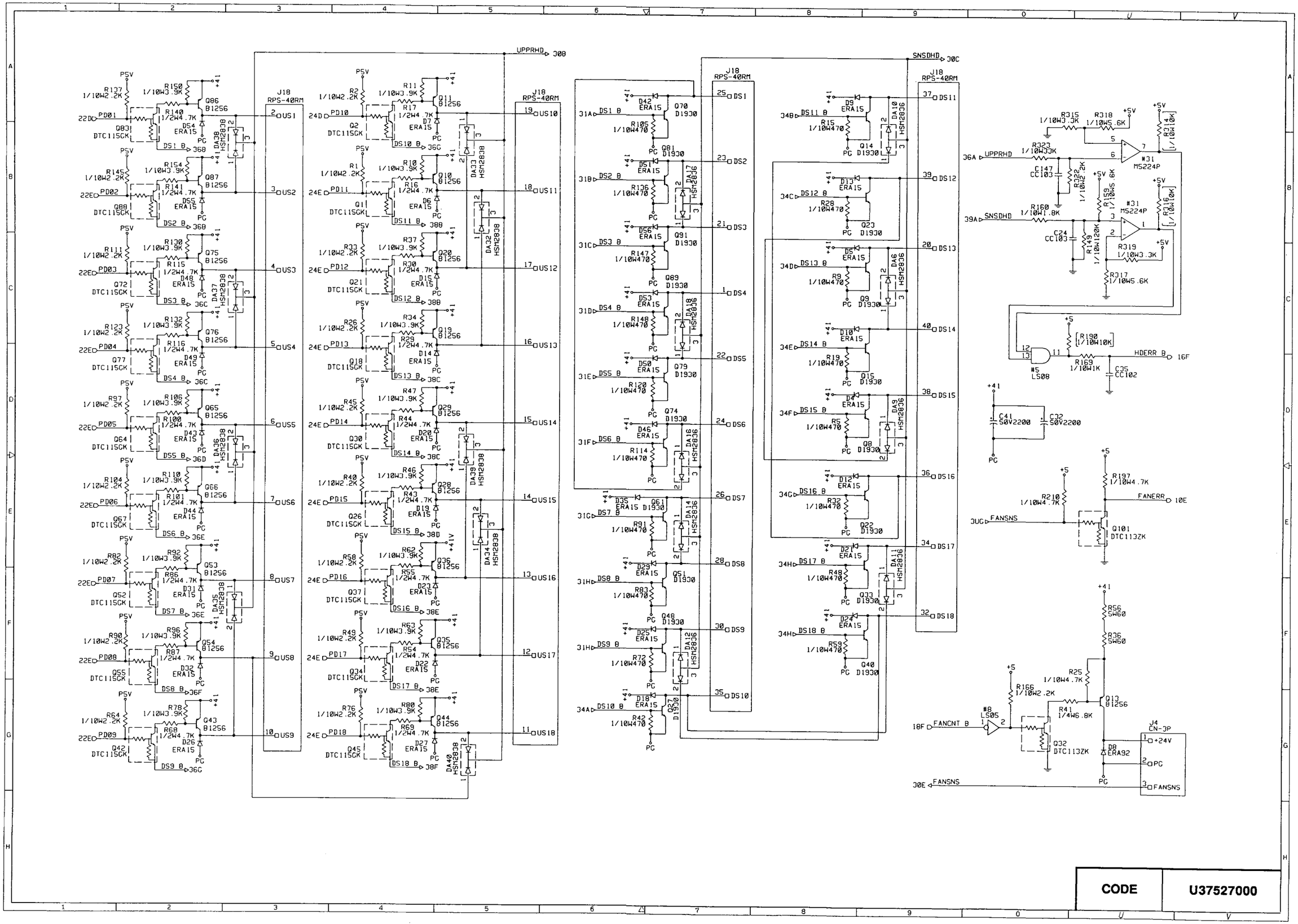
A. Logic Control Circuitry Schematic Diagrams
B. Switch Panel Circuitry Schematic Diagram
C. Power Supply Circuitry Schematic Diagrams
D. Interface Circuitry Schematic Diagram
E. Wiring Diagram

Appendix A-1. Logic Control Circuitry Schematic Diagram

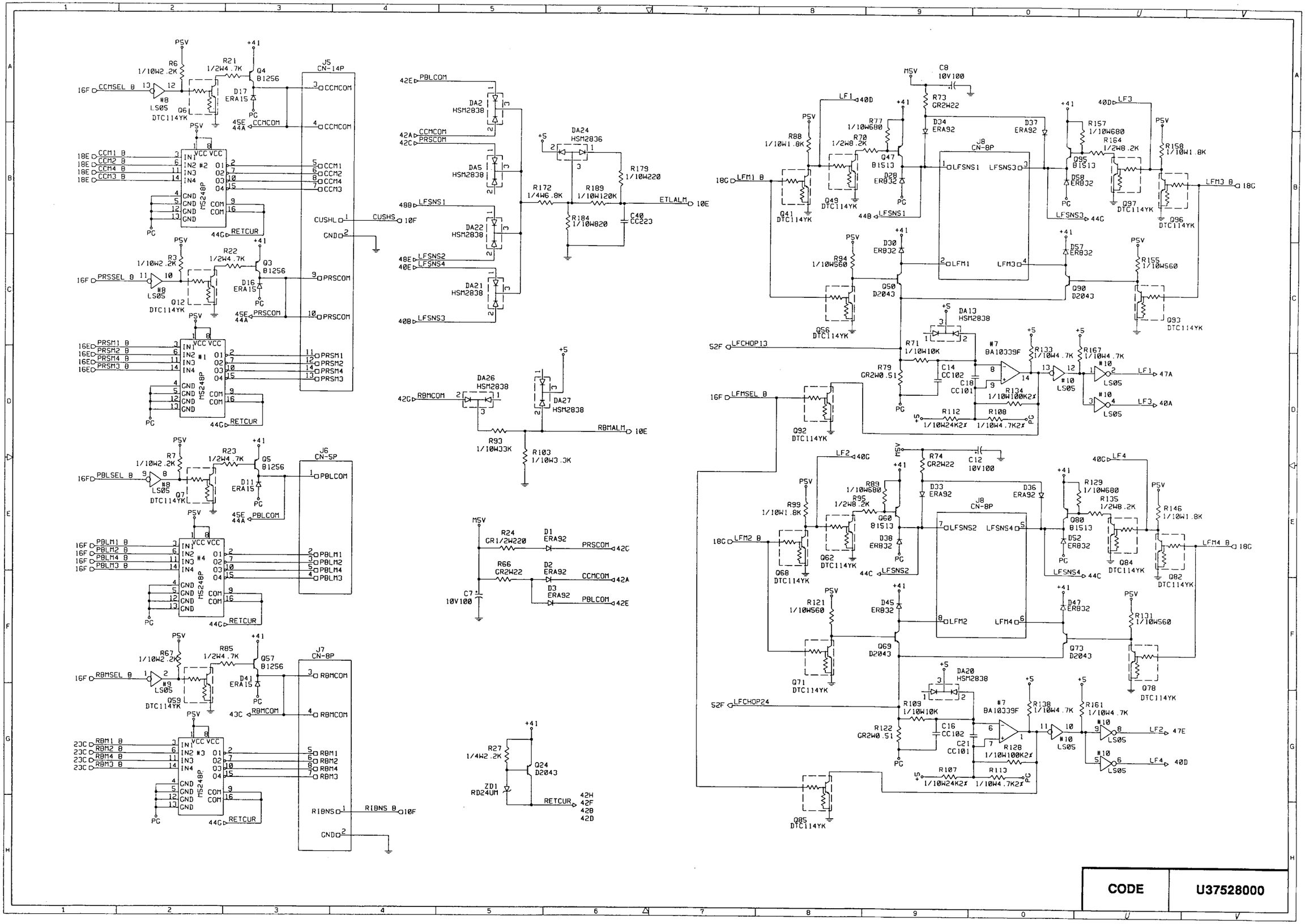


Appendix A-2. Logic Control Circuitry Schematic Diagram



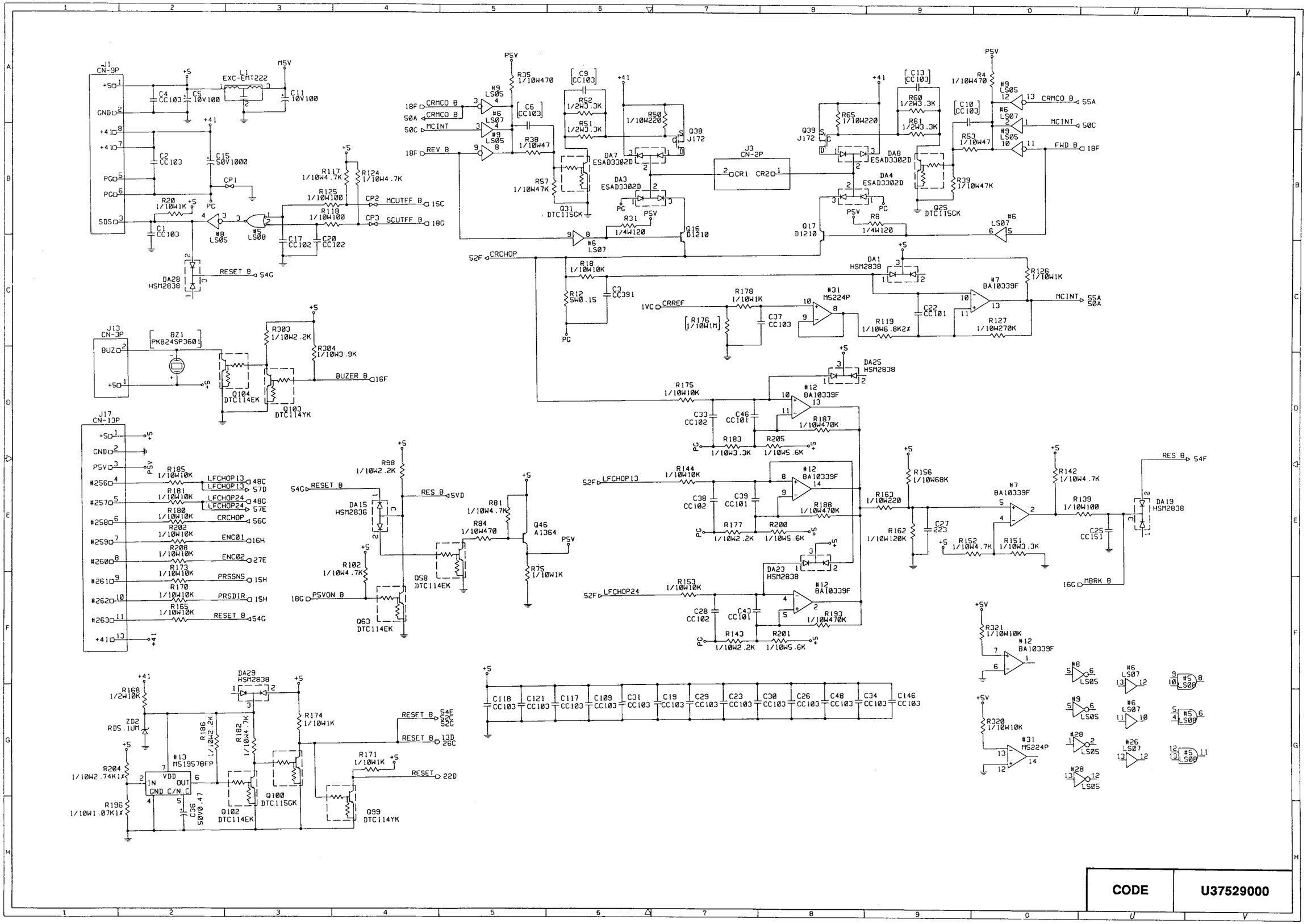

UPPRHD
SNSDHD
J18 RPS-40RM
US1
US2
US3
US4
US5
US6
US7
US8
US9
US10
US11
US12
US13
US14
US15
US16
US17
US18
DS1
DS2
DS3
DS4
DS5
DS6
DS7
DS8
DS9
DS10
DS11
DS12
DS13
DS14
DS15
DS16
DS17
DS18
HDERR B
FANERR
FANSNS
FANCNT B
CODE
U37527000
A-3

Appendix A-4. Logic Control Circuitry Schematic Diagram



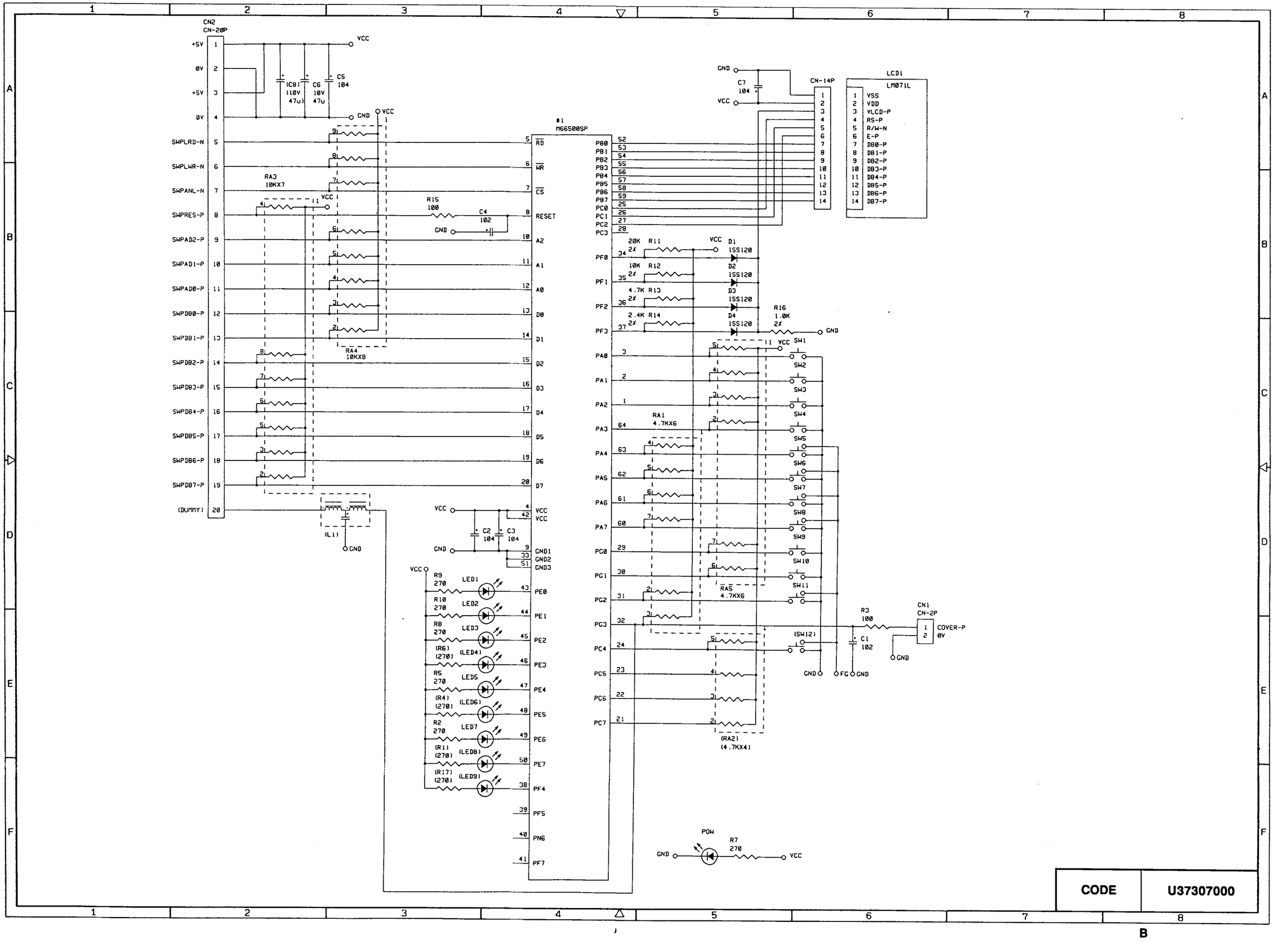
CODE	U37528000

Appendix A-5. Logic Control Circuitry Schematic Diagram



CODE	U37529000

Appendix B. Switch Panel Circuitry Schematic Diagram



CODE	U37307000

B

Appendix C-1. Power Supply Circuitry Schematic Diagram (100V Series)

1. RX 及ビ CXハ、実機調整ニ合ワセテ、別表ヨリ適当ナ値ヲ選別スル。(回路図中ハ標準値)

1. SELECT A PROPER VALUE OF RX AND CX ACCORDING TO ACTUAL ADJUSTMENT WITHIN THE TABLE. (INDICATED TYP. ON THE CIRCUIT DIAGRAM)

別表 (注記1参照)
TABLE (REF. NOTE 1)

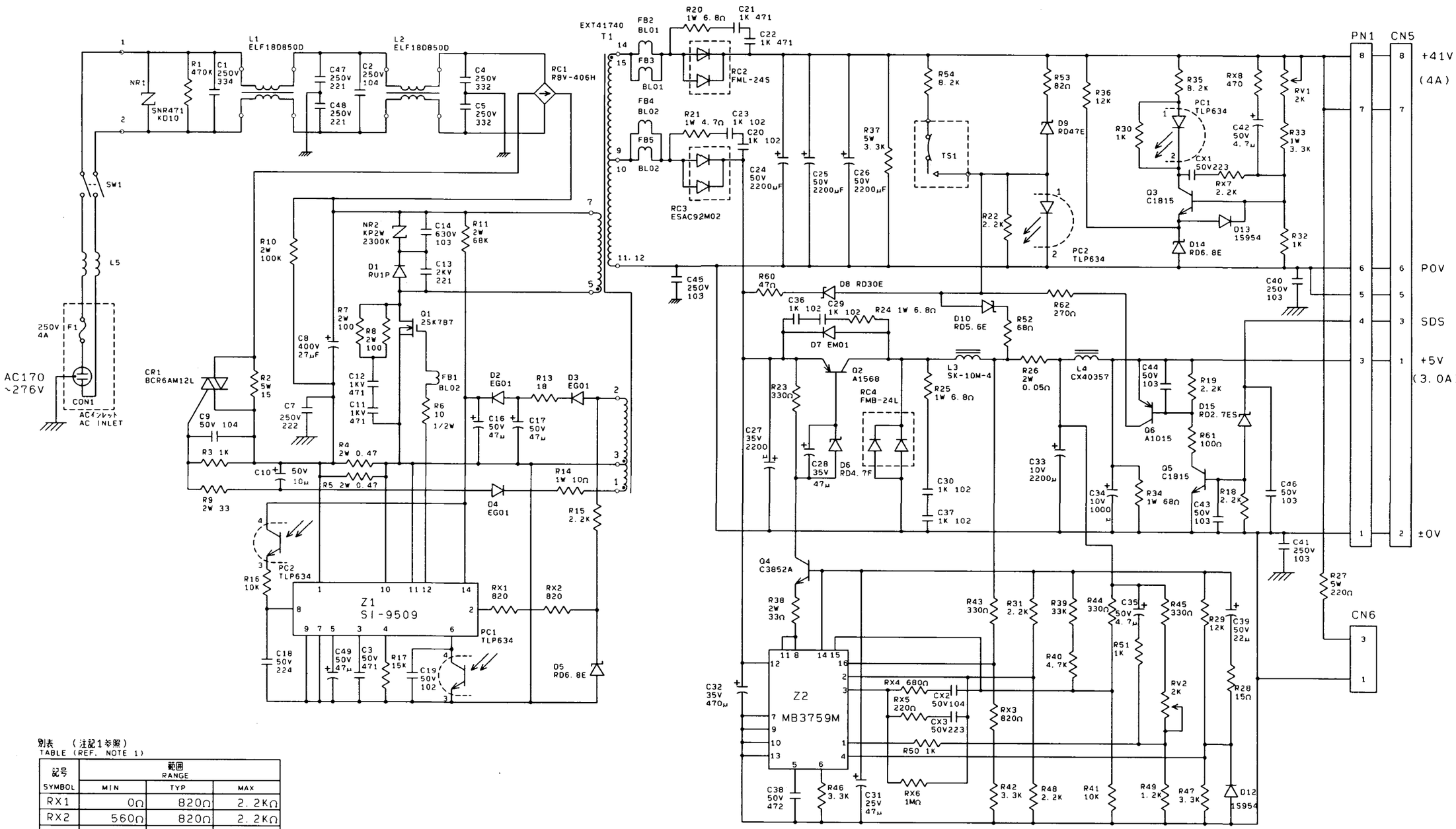
記号 SYMBOL	範囲 RANGE MIN	TYP	MAX
RX1	0Ω	680Ω	1.5KΩ
RX2	560Ω	820Ω	2.2KΩ
RX3	470Ω	820Ω	5.6KΩ
RX4	220Ω	680Ω	4.7KΩ
RX5	47Ω	220Ω	4.7KΩ
RX6	56KΩ	1MΩ	1MΩ
RX7	0Ω	2.2KΩ	5.6KΩ
RX8	100Ω	220Ω	10KΩ
CX1	0.001μF	0.1μF	0.22μF
CX2	0.01μF	0.1μF	0.22μF
CX3	0.01μF	0.022μF	0.22μF

CODE	U37541000

Appendix C-2. Power Supply Circuitry Schematic Diagram (200V Series)

1. RX 及ビ CXハ、実機調整ニ合ワセテ、別表ヨリ適当ナ値ヲ選別スル。(回路図中ハ標準値)

1. SELECT A PROPER VALUE OF RX AND CX ACCORDING TO ACTUAL ADJUSTMENT WITHIN THE TABLE. (INDICATED TYP. ON THE CIRCUIT DIAGRAM)

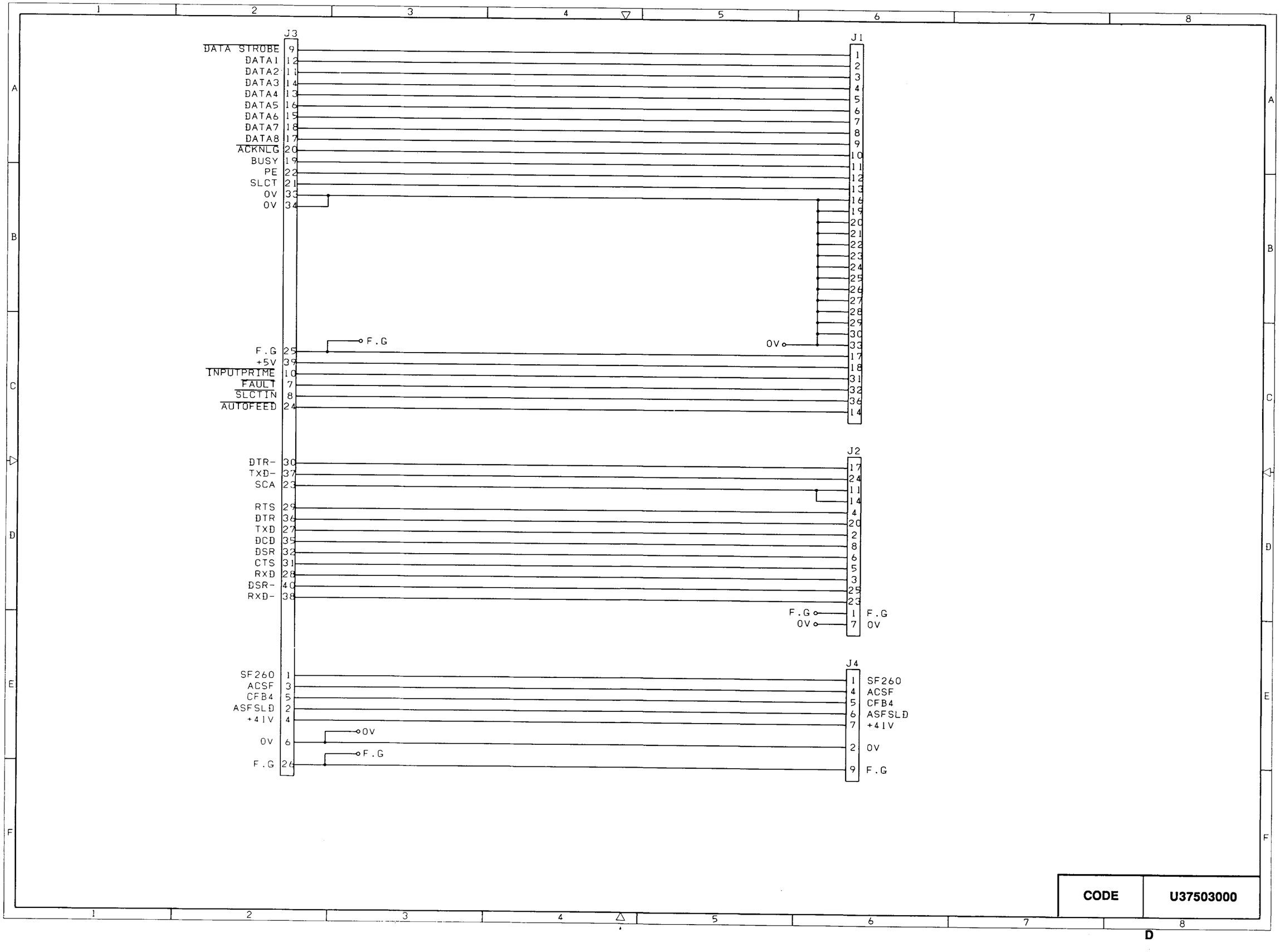


別表 (注記1参照)
TABLE (REF. NOTE 1)

記号 SYMBOL	範囲 RANGE MIN	TYP	MAX
RX1	0Ω	820Ω	2.2KΩ
RX2	560Ω	820Ω	2.2KΩ
RX3	220Ω	820Ω	5.6KΩ
RX4	220Ω	680Ω	4.7KΩ
RX5	47Ω	220Ω	4.7KΩ
RX6	56KΩ	1MΩ	1MΩ
RX7	0Ω	2.2KΩ	5.6KΩ
RX8	100Ω	470Ω	10KΩ
CX1	0.001μF	0.022μF	0.22μF
CX2	0.01μF	0.1μF	0.22μF
CX3	0.01μF	0.022μF	0.22μF

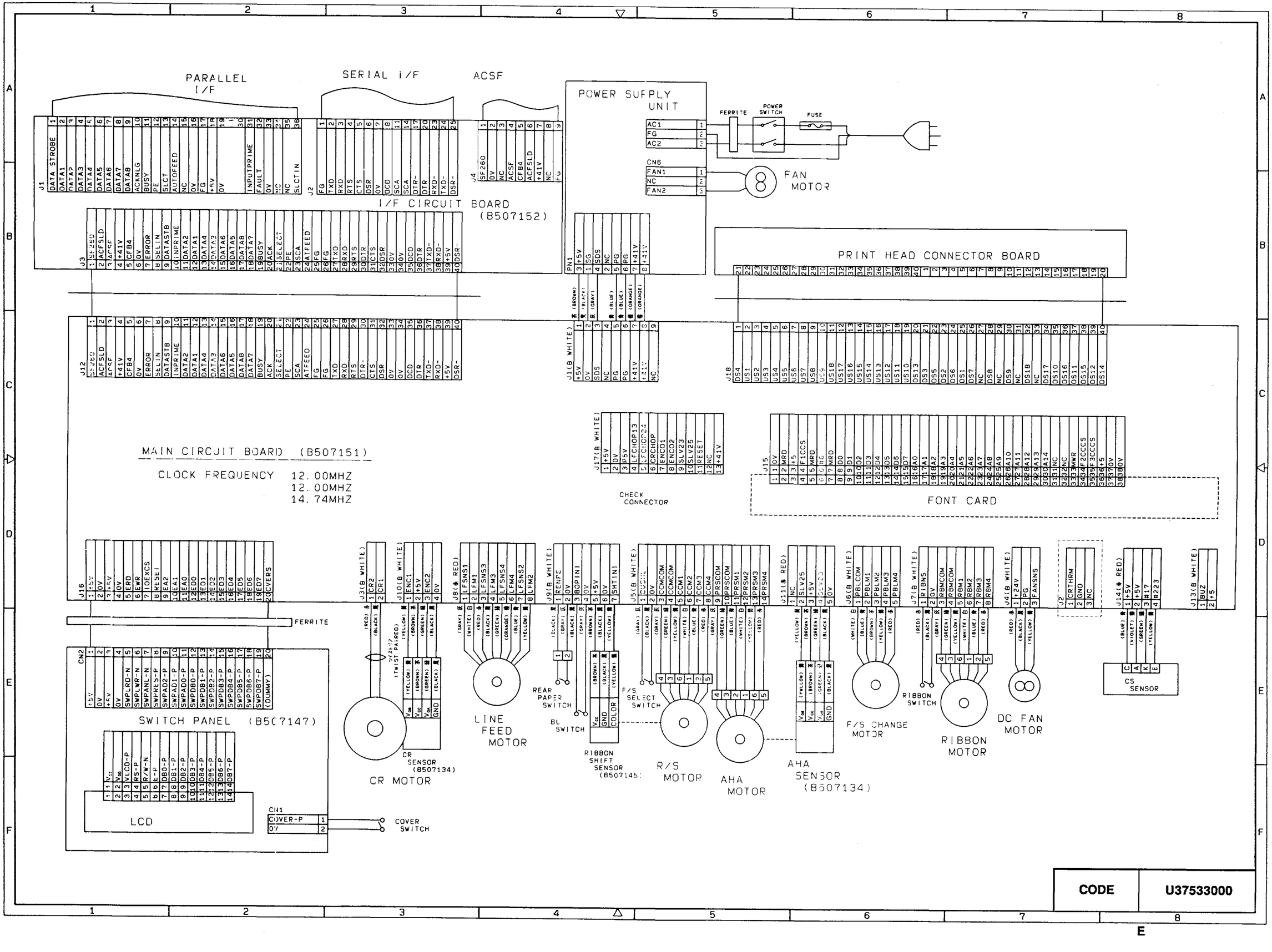
CODE	U37542000

Appendix D. Interface Circuitry Schematic Diagram



CODE	U37503000

Appendix E. Wiring Diagram



CODE	U37533000

Option: Pull-up Tractor Feeder

CONTENTS

CHAPTER I. APPLICATION 1

CHAPTER II. PARTS REPLACEMENT 1

2.1 Tractor L 1
2.2 Tractor R 3
2.3 Bushing 4

1. APPLICATION

The pull-up tractor feeder is an option designed for the dot matrix printer. It facilitates handling of continuous forms.

2. PARTS REPLACEMENT

2.1 Tractor L

a. Removal

(1) Remove the screw (a) and take off the side cover L.

(2) Remove the snap ring (b) and screw (c) from the pull-up tractor drive shaft and rail, respectively, to take off the left pull-up tractor frame.

(3) Remove the snap ring (d) from the pull-up tractor drive shaft, then slide the tractor L off the shaft.

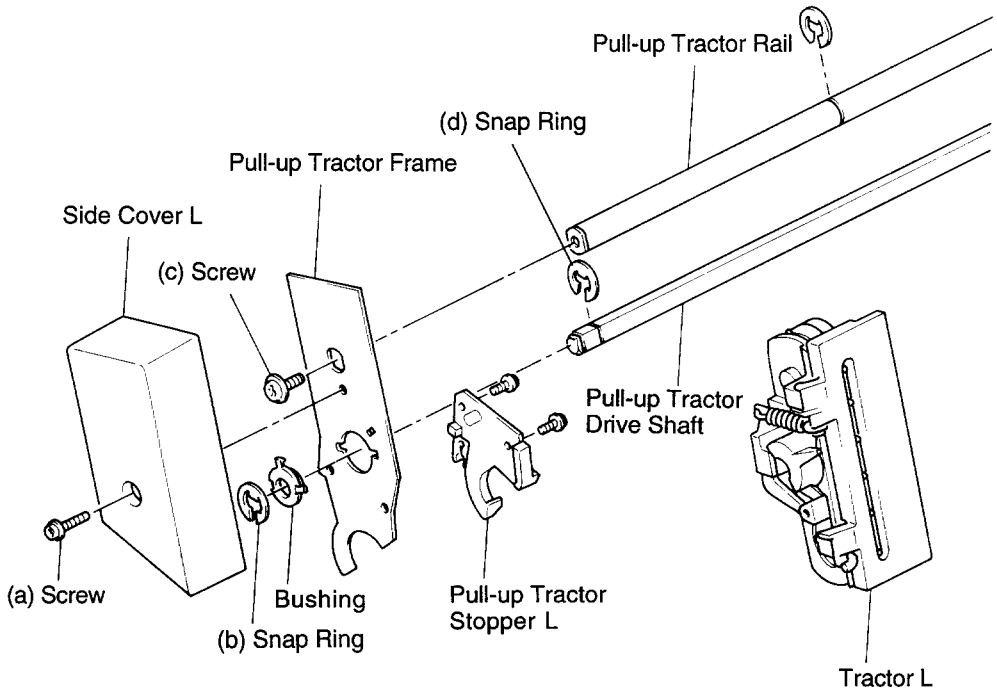


Figure 2.1 Removing Tractor L

b. Installation

Reverse the removal procedure.

NOTES • When inserting the pull-up tractor drive shaft through tractors R and L, be sure to align the markings on the tractor pulleys with each other. Also make sure that the phases of the pin wheels are aligned with each other.

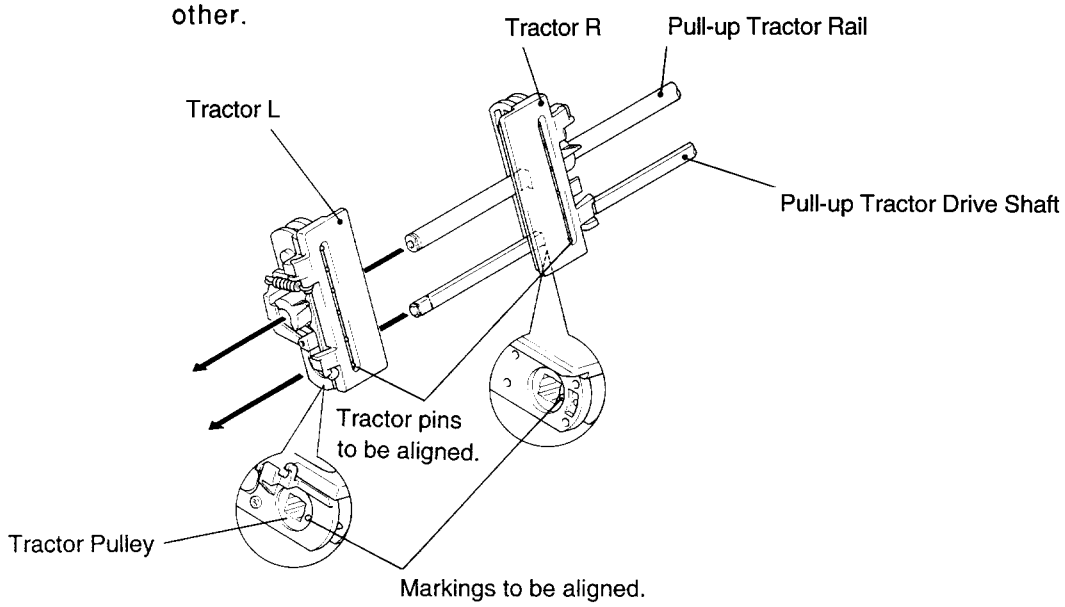


Figure 2.2 Inserting the Pull-up Tractor Drive Shaft

• When installing the side cover L, push it as shown below so that there is no gap between the side cover L and the left pull-up tractor frame.

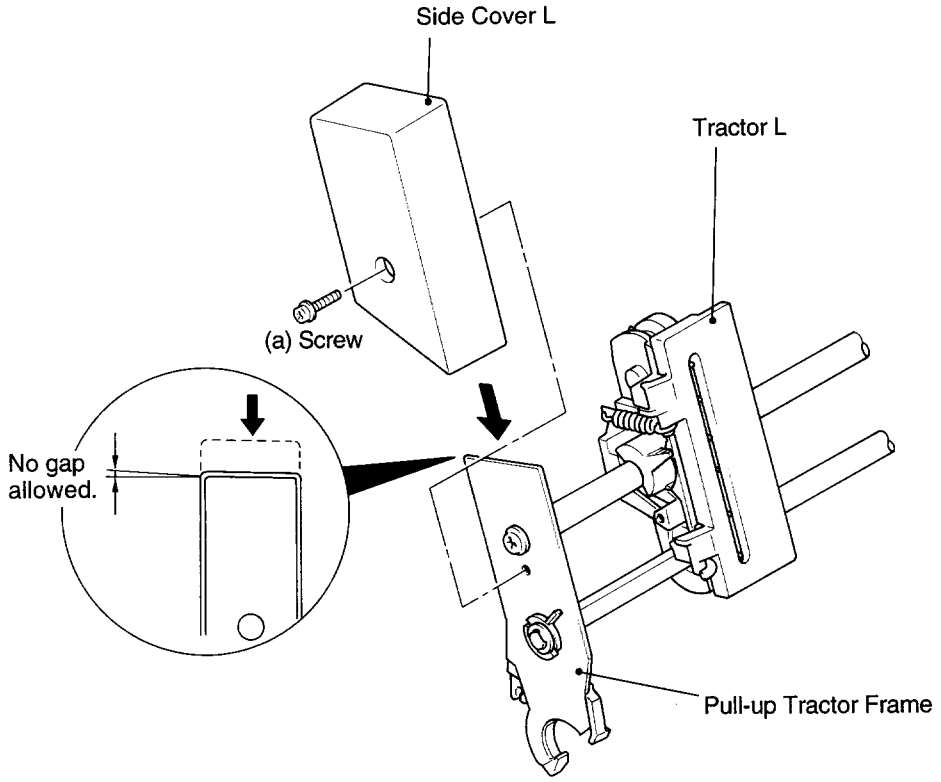


Figure 2.3 Installing the Side Cover L

2.2 Tractor R

a. Removal

(1) Remove the screw (e) and take off the side cover R.

(2) Remove the snap ring (f) from the pull-up tractor drive shaft and take off the pull-up tractor drive gear (g).

(3) Remove the screw (h) from the pull-up tractor rail to take off the pull-up tractor frame R.

(4) Remove the snap ring (i) from the pull-up tractor drive shaft, then slide the tractor R off the shaft.

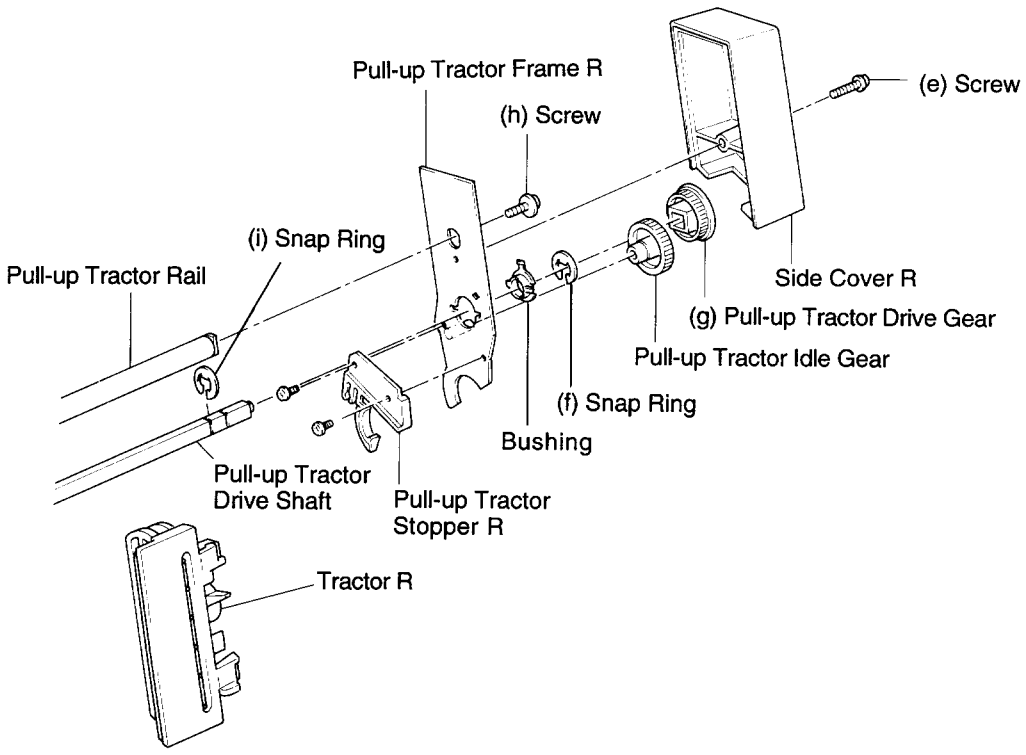


Figure 2.4 Removing Tractor R

b. Installation

Reverse the removal procedure.

NOTES

- When inserting the pull-up tractor drive shaft through tractors R and L, be sure to align the phases of the pin wheels with each other. (See Figure 2.2.)
- When installing the side cover R, follow the same notes as for side cover L to eliminate any gap between the cover R and frame R. (Refer to Figure 2.3.)

2.3 Bushings

a. Removal

Turn the bushing 90° and pull it outwards. (There is one on each of the pull-up tractor frames.)

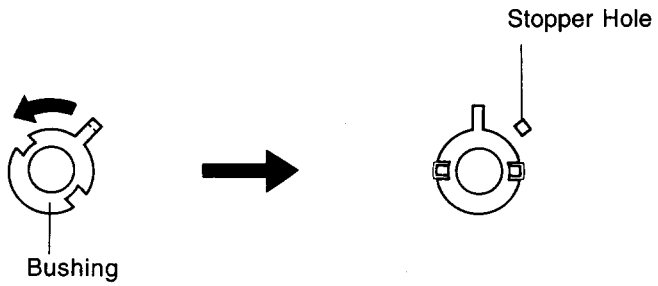


Figure 2.5 Removing the Bushing

b. Installation

Reverse the removal procedure.

NOTE: Turn the bushing until its hook is surely fitted into the stopper hole provided in the pull-up tractor frame.

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